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ABSTRACT

This guide was developed for teachers to use in helping students understand components of the urban ecosystem. The guide is based on sequentially arranged performance objectives for each concept. Organization of the guide includes activities designed to link the urban units with the forest ecology unit which overlap in concepts and philosophy. A pre/post-test is also included. (Author/RH)

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ECOLOGY OF THE CITY

THE CITY IS . . .

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DUVAL COUNTY SCHOOLS

1976

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The development of this teacher's guide was a 1975 Florida Department of Education environmental education mini-grant project.

Preface

Man living in tune with his environment--not a new idea, certainly, but one that began losing credibility with the commencement of the Industrial Revolution.

In prehistory man had little choice but to live with his environment, wrapping what protection about him he could. But his life rhythm pulsed with nature's--its seasons, births, deaths, suns and moons. He paid careful attention to its sequence if he wanted to survive.

When man began improving on nature to the point that he excluded it, he forgot its importance to his life. The distance between rhythms grew wider, discordant.

Finally nature raised a warning hand. Her skies would take up just so much contaminants before raining them back down. Her waterways would take just so much sludge before expiring. Her marshes could sponge up just so much filth before marine nurseries would putrefy.

Students of urban ecology today are going to face an ever-increasing burden of environmental choices. These choices will be difficult. The students will require a background of knowledge in several disciplines since the solutions to environmental problems usually encompass the entire spectrum of human thought and activity. For example, determination of the level of pollution in the St. Johns River is but the first step in the solution of the problem. Correction of the problem will involve input from businessmen, industrialists, environmentalists, politicians, governmental agencies, the media and the general public. Attaining environmental quality is everybody's business. If students are going to be asked to make intelligent choices, they are going to need you to provide them with much of the background information they will need.

It is difficult to predict the experiences and knowledges students will need in the future. However, a few basics are evident. It seems logical to assume that a student cannot make intelligent choices until he is aware of the problem. Next, he needs some basic knowledges about the elements inherent to the problem. Finally, after the student is aware of the problem and has knowledge about it, he must be made aware of the tools available to effect a solution. Thus, awareness of the environment, knowledge of the factors involved and action in the sense of effecting a solution are necessary steps in educating a student to prepare him for environmental choices.

HOW TO USE THIS DESIGN

This design for urban ecology was developed as an instrument for teachers to use in leading students to an understanding of the components of urban ecosystem, how man affects these components, and the need for immediate and long range planning to insure a quality urban environment.

The design is based upon the conceptual scheme which encompasses these understandings. Sequentially arranged performance objectives accompany the concepts. For each concept the learner should demonstrate proficiency in the following order:

1) learning steps (3.1.2.1, 2.1.2.2, for example)
2) intermediate performance (3.1.2, for example)
3) terminal performance (3.1, for example)

After each of the terminal performance objectives (Part I-3.1, and Part II-3.2 and 3.3) has been reached according to its stated criterion of success, the learner should be able to demonstrate his understanding of the entire conceptual scheme by successfully completing the unit test (3.0)

Performance objectives, test questions, and a selection of student activities are included in this design.

A breakdown of the conceptual scheme, an answer key for all performance objectives, and a general resource guide are located in the front of the design for easy access by the teacher.

A planned field trip should be taken before the test for Part I-Objectives 3.1 is given.

The section at the end of Part I is an activity designed to link this unit with the unit on forest ecology. The two units overlap in design, concept, and philosphy. Therefore, this activity is to be used only when both urban ecology and forest ecology have been taught.

Conceptual Scheme for Ecology of a City

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

Part I: The City Is . . .

- 3.1 Resources in an urban ecosystem
  - 3.1.1 The ways land is used in the city
    - 3.1.1.1 The types of housing in the city
    - 3.1.1.2 The types of industries in Jacksonville
    - 3.1.1.3 The types of commerce in Jacksonville
    - 3.1.1.4 The types of transportation serving Jacksonville
    - 3.1.1.5 The uses by government of land in Jacksonville
  - 3.1.2 How man affects urban air
    - 3.1.2.1 The kinds and sources of urban air pollutants
    - 3.1.2.2 How cities make their own weather
  - 3.1.3 The importance of ground and surface water to the City of Jacksonville
    - 3.1.3.1 The supply, distribution and use in the city of ground water
    - 3.1.3.2 Characteristics and function of surface water in the city
      - 3.1.3.2.1 The characteristics of the St. Johns River
      - 3.1.3.2.2 The functions of surface water in the City of Jacksonville
  - 3.1.4 To recognize urban plants and animals, their habitats, food and adaptations
    - 3.1.4.1 To recognize urban plants, their habitats and adaptations

3.1.4.1.1 Some of the urban plants are cultivated by man

3.1.4.1.2 Some urban plants are volunteers

3.1.4.2 Urban animals, their habitats, food and adaptations

3.1.5 The sources and kinds of energy used in Jacksonville

Part II: The City Should Be . . .

3.2 Man must use planning to bring about controlled change

3.2.1 The ways man may control the quality of air, water and land

3.2.1.1 The ways man may control the quality of air

3.2.1.2 The ways man may control the quality of water

3.2.1.3 The ways man may control the quality of land

3.2.2 The factors of an urban environment which may disturb man's sensibilities

3.2.3 Planning is required to make the needs of the people in an urban ecosystem compatible with their environment

3.3 Man lives in a complex system of interlocking factors none of which can be changed without affecting the others

3.0 Mission Objective

For intermediate grade students of environmental studies to develop a comprehension of the interdependencies which occur within an urban environment and to demonstrate a positive feeling toward a quality urban environment. Success will be determined by 75% compliance with the following:

> Given keyed maps of two towns and 12 questions requiring comparisons, the students will place on the line before each question the letter of the town which fits the question. Minimum 10.
>
> Given a numbered list of resources and unnumbered lists of problems and controls, the student will correctly match the resource number to the appropriate item in each of the other lists. Minimum 8.
>
> Given 8 questions concerning an urban environment, the student will check the most positive response from a given list of 5 responses which have been weighed as to value. Minimum 32 points.

Note: The test for the Mission Objective will be found in Ecology of the City, Part II: The City Should Be... (To be developed)

3.1 TPO Criterion Test

For intermediate grade students of environmental studies to develop an awareness of the resources in an urban ecosystem so that 75% of the students studying urban resources will in Part I, correctly answer 9 of 10 by checking two in each group which are ecologically related and in Part II, correctly answer 9 of 10 multiple choice questions.

Part I

1. ___ air
   ___ ground water
   ___ surface water

2. ___ pigeon
   ___ wildcat
   ___ squirrel

3. ___ industry
   ___ waves
   ___ septic tanks

4. ___ smokestacks
   ___ automobiles
   ___ plants

5. ___ beach
   ___ shopping center
   ___ park

6. ___ hospital
   ___ apartment
   ___ trailer

7. ___ oil
   ___ nuclear
   ___ coal

8. ___ rose
   ___ goldenrod
   ___ azalea

9. ___ ashes
   ___ dust
   ___ hail

10. ___ paper
    ___ nursing
    ___ cigar

Part II

11. Energy, because it cannot be recycled, is most like

    a. aluminum
    b. smoke
    c. bottles

12. In Jacksonville at the present time it is not necessary to use river water in our homes and businesses because

    a. we have a plentiful supply of underground water
    b. we purify salt water
    c. of the amount of rainfall we receive

13. The weather in Jacksonville may be different from that or rural areas because

    a. trees grow in large cities
    b. of prevailing winds
    c. cities affect their own weather

14. Compared to land in the country, city land is

    a. more expensive
    b. less expensive
    c. about the same price

15. The St. Johns River is most important to Jacksonville because

    a. it makes it a port city
    b. it is a convenient dumping place for wastes
    c. it flows north

16. The largest amount of developed land in Jacksonville is used for

    a. airports
    b. housing
    c. highways

17. Pollution is a serious problem in cities. Another serious city problem is

    a. animal pests
    b. weeds
    c. falling leaves

18. The use of fewer cars in Jacksonville would improve our air quality. Citizens could meet this need by

    a. driving to work
    b. paying more for gasoline
    c. using buses

19. Because of the action of tides and wind the St. Johns River may cease emptying any water into the ocean. This makes the river

    a. less polluted
    b. more polluted
    c. colder

20. The St. Johns River separates the city of Jacksonville. This causes a problem for

    a. fishermen
    b. TV reception
    c. transportation

3.1 Answer Key

This key contains answers for all tests in this booklet.

3.1

1.	ground water surface water	11.	b
2.	pigeon squirrel	12.	a
3.	industry septic tanks	13.	c
4.	smokestacks automobiles	14.	a
5.	beach park	15.	a
6.	apartment trailer	16.	b
7.	oil coal	17.	a
8.	rose azalea	18.	c
9.	ashes dust	19.	b
10.	paper cigar	20.	c

3.1.1

1.	b	6.	a	11.	b
2.	c	7.	b	12.	c
3.	a	8.	c	13.	a
4.	a	9.	a	14.	b
5.	b	10.	c	15.	c

3.1.1.1		3.1.1.2		3.1.1.3	
1.	c	1.	a	1.	b
2.	a	2.	c	2.	c
3.	a	3.	b	3.	a
4.	b	4.	c	4.	c
5.	c	5.	a	5.	b

3.1.1.4		3.1.1.5	
1.	c	1.	c
2.	a	2.	a
3.	b	3.	a
4.	a	4.	b
5.	b	5.	c

ANSWER KEY (CONT.)

3.1.2	1.	b
	2.	a
	3.	a
	4.	b
	5.	c
	6.	a
	7.	a
	8.	b
	9.	c
	10.	b

3.1.2.1	1.	c
	2.	b
	3.	a
	4.	a
	5.	b
	6.	a
	7.	a
	8.	c

3.1.2.2	1.	c
	2.	c
	3.	a
	4.	b
	5.	a
	6.	b
	7.	c
	8.	b

3.1.3	1.	b
	2.	a
	3.	c
	4.	b
	5.	c
	6.	b
	7.	c
	8.	a
	9.	c
	10.	a
	11.	b
	12.	c
	13.	b
	14.	a
	15.	b

3.1.3.1	1.	a
	2.	c
	3.	c
	4.	a
	5.	b
	6.	c
	7.	a
	8.	b
	9.	c
	10.	b

3.1.3.2	1.	b
	2.	c
	3.	a
	4.	a
	5.	a
	6.	c
	7.	b
	8.	b
	9.	a
	10.	c

3.1.3.2.1	1.	a
	2.	b
	3.	c
	4.	a
	5.	b

3.1.3.2.2	1.	b
	2.	c
	3.	b
	4.	a
	5.	c
	6.	a
	7.	c
	8.	b
	9.	a
	10.	c

ANSWER KEY (CONT.)

3.1.4
1. b
2. c
3. c
4. a
5. a
6. b
7. a
8. b
9. c
10. c

3.1.4.1
1. a
2. c
3. a
4. b
5. b
6. c
7. c
8. a
9. b
10. a

3.1.4.1.1
1. pear trees
2. petunias
3. vegetables
4. pansies
5. golden rain trees
6. tulips
7. flowering trees
8. roses
9. St. Augustine grass
10. dogwood trees

3.1.4.1.2
1. palmetto
2. ferns
3. toadstools
4. scrub oak
5. honeysuckle
6. clover
7. dandelion
8. wild grasses
9. magnolia
10. thistles

3.1.4.2
1. b
2. c
3. b
4. a
5. c
6. b
7. b
8. a
9. b
10. c

3.1.5
1. a
2. c
3. b
4. b
5. c
6. c
7. b
8. a
9. c
10. a

Resource Guide

1. Films

These films may be ordered from the School Media Center, 31 Warren Street.

Title	Objective
"Energy: Can't Do Without It"	3.1.5
"The Great Search: Man's Need for Power and Energy"	3.1.5
"Energy and Living Things"	3.1.5
"The Energy Challenge"	3.1.5
"Recycling and Resources"	3.2.1.3
"The City Changes"	3.2
"Life in a Vacant Lot"	3.1.4
"Jobs in the City: Services"	3.1.1.3
"Problems of Conservation: Air"	3.1.2, 3.2.1.1
"Air Pollution"	3.1.2, 3.2.1.1
"Overload"	3.1.2, 3.2.1.1
"Gateway to the Future"	3.1.1
"The Problem with Water Is People"	3.1.3
"Water for the City"	3.1.3
"The Town that Washes Its Water"	3.1.3
"Hard Water"	3.1.3
"Pipes in the House"	3.1.3
"Wonders in Your Own Backyard"	3.1.4
"A Port Prepared"	3.2.1.2
"Birds in the City"	3.1.4
"What Makes a City"	3.1

2. Kits

Filmstrip Set, Man and the Cities, Series 1: City Problems and Alternatives
Filmstrip Set, Man and the Cities, Series 1: Economics of the City
Community Game
Man in His Environment
Ecology: The City
Slide set: types of housing

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

THE CITY IS. . . .

Part I 3.1 Resources in an urban ecosystem

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    - 3.1.4.1.1 Some of the urban plants are cultivated by man
    - 3.1.4.1.2 Some urban plants are volunteers
  - 3.1.4.2 Urban animals, their habitats, food, and adaptations
- 3.1.5 The sources and kinds of energy used in Jacksonville

3.1.1 IPO Criterion Test

For intermediate grade students of environmental studies to develop an awareness of the ways land is used in the city so that at least 75% of the students will answer correctly 13 of 15 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Mobile homes are often used by navy people because they are

   a. permanent
   b. movable
   c. large

2. Since city land is becoming scarce, in order to provide more housing we should build more

   a. single family houses
   b. trailers
   c. apartments

3. One of the major industries in Jacksonville is paper and pulp because there are

   a. nearby pine flatwoods
   b. coal deposits
   c. orange groves

4. In Jacksonville turpentine is produced from pine wood by

   a. chemical plants
   b. packaging plants
   c. fertilizer plants

5. The shipbuilding industry in Jacksonville produces many

   a. ocean liners
   b. shrimp boats
   c. destroyers

6. A useful labor that does not produce a product is called a

   a. service
   b. good
   c. resource

7. Jacksonville has many tourists because of the

   a. boarding houses
   b. interstate highway system
   c. shipping industry

8. Most of the federal employment in the Jacksonville area is made up of civilian employment at

   a. airports
   b. post offices
   c. naval bases

9. Distribution of ship-borne goods from Jacksonville is made easier because of the

   a. railroad network
   b. airports
   c. good docks

10. Publicly owned land for streets and highways is also used for

    a. stores
    b. billboards
    c. utility lines

11. Fort Caroline National Park is owned and operated by the

    a. City of Jacksonville
    b. federal government
    c. school system

12. One way to encourage people to shop downtown is to provide

    a. more stores
    b. more streets
    c. more parking areas

13. Shopping malls have been built in the suburbs

    a. to make shopping easier
    b. to keep people from using the bridges
    c. to connect with bus lines

14. Land development in Jacksonville is moving

    a. downtown
    b. south and east
    c. north and west

15. The beach is owned

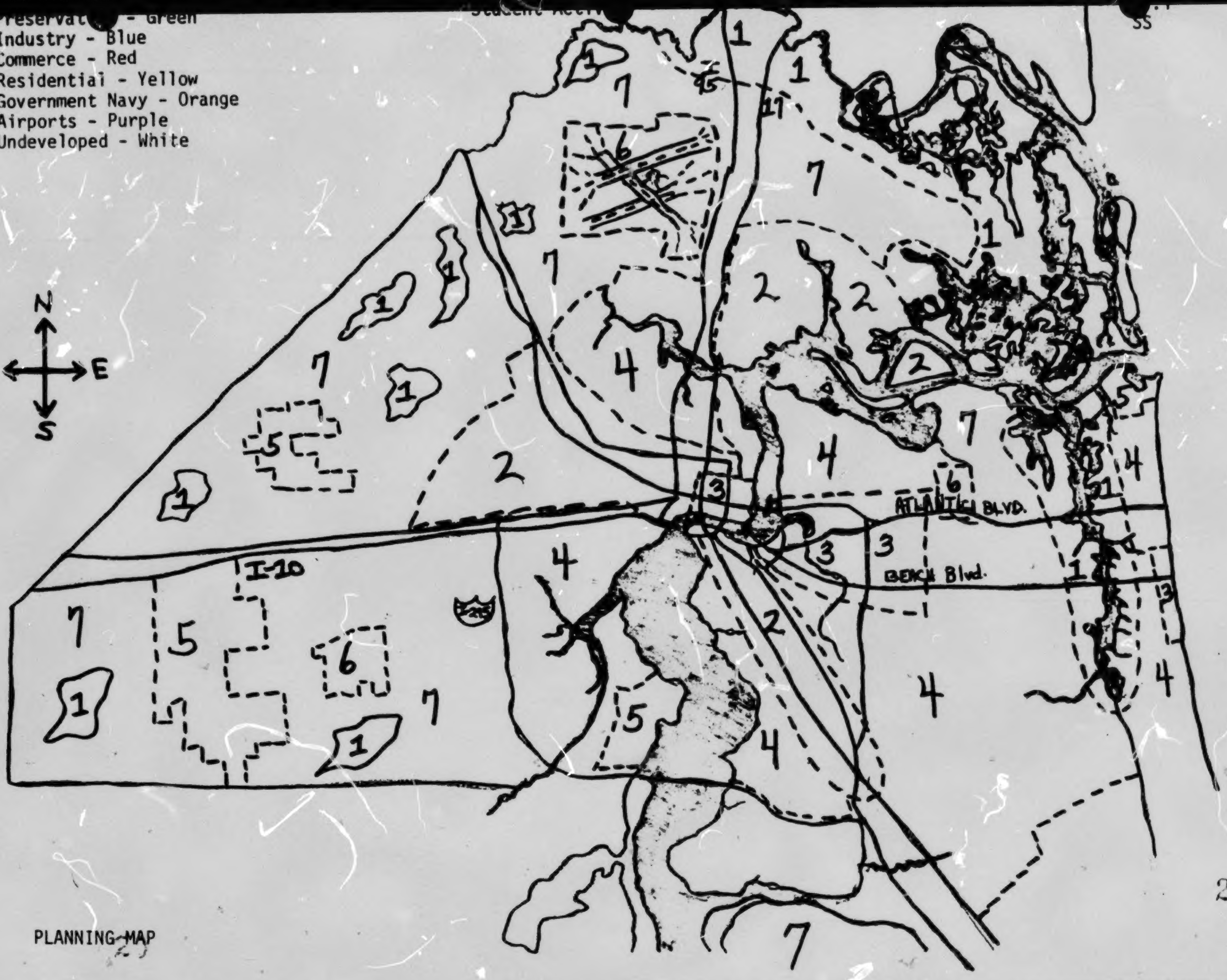
    a. by the people who live along the oceanfront
    b. by the navy
    c. publicly

Planning Map
(Directions for Use)

Using the map and color code, color in the map areas to show how land is used in Duval County. Using the map, answer the following questions:

1. How many areas show government use? ______________________.
2. Most of the land used for preservation is found near ______________________.
3. Most of the undeveloped land is found in what part of the county? ______________________
4. At the beaches, the commercial land area is found near the ______________________.
5. The downtown area is used for ______________________ purposes.

1. Preservat - Green
2. Industry - Blue
3. Commerce - Red
4. Residential - Yellow
5. Government Navy - Orange
6. Airports - Purple
7. Undeveloped - White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BEACH Blvd.
I-10
295

PLANNING MAP

3.1.1.1 Criterion Test. Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the types of housing in the city so that at least 75% of the students answer correctly 4 of 5 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. In the inner city housing is changing to more
   a. single family houses
   b. country estates
   c. multiple family units
2. A popular form of housing is the trailer or
   a. mobile home
   b. rig
   c. cabin
3. A condominium is an apartment that is
   a. bought
   b. rented
   c. borrowed
4. Most single family houses are found
   a. in the inner city
   b. in the suburbs
   c. along the river
5. Many large older homes have been turned into
   a. single family dwellings
   b. libraries
   c. rooming houses

To the Teacher

Housing

The quantity of housing has increased and the quality has improved markedly since 1960. The greatest changes that have occurred over the past fifteen years are in the type of structure in which people are living in Jacksonville. A much higher percentage of the population has moved into mobile homes and apartments.

The housing stock in Jacksonville has improved perceptibly and especially so since 1968, the year of government consolidation. In 1960, there were over 27,000 substandard dwelling units in Jacksonville, accounting for nearly one-fifth of the total housing stock. In the intervening decade, because of code enforcement and demolition, the number of substandard units was reduced to 15 percent. This meant, however, that there were still 23,000 substandard dwellings.

Student Activity

3.1.1.1
MA

Housing Near Your School

1. Find a place near your school where new houses are being built. Look at several of the houses.
2. How large is the piece of land that goes with each house?
3. What shape is it? Are all the lots the same shape?
4. Which direction do the houses face?
5. Make a map of the new area and find different ways to face each of the houses.

   Would this be a good idea? Why?

Source: Ecolab

Student Activity

3.1.1.1
MA, SS

Housing Near Your School

1. Find a place near your school where new houses are being built.
2. How many homes were there last year? How many are there now?
3. How long does it take to build a house?
4. How much money would you have to pay for the house that you like the best?
5. Where might you get the money to pay for the house?

Source: Ecolab

Student Activity

3.1.1.1
SS

On A Street In a Neighborhood

1. How many houses are single story?
2. How many are two story?
3. How many are neither of these? What are they called?
4. Which kind of homes have the most rooms?
5. Which houses look the largest?

Source: Ecolab

Student Activity

3.1.1.1
SS

Different Kinds of Housing

What You May Learn:

There are lots of different kinds of housing in and around our city. Some of them you might like to live in; some you probably would not. It's fun to guess about the people who do live in them just from looking at their houses.

Materials:

Set of 15 slides, projector and screen or Camera, film and a way to go exploring for the examples for your class.

Procedure:

1. With your teacher, try taking the pictures. You might decide ahead of time on where to look for what example, or you may label your slides after your housing tour.

2. Now why don't you choose your 3 favorite and tell why you like them on Worksheet #1. Will you do the same for the 2 you like the least?

   Now go to the other worksheets.

3. For slides 1 - 5, you will try to decide how many rooms there are in each unit. (A unit is a dwelling place for one family). For slides 6 - 11, you are to guess what kind of job the owner has. And, for slides 6 - 11, could you figure out which would be the most expensive to live in and which the least?

   You'll be asked to give reasons for your opinions.

SLIDES

1. Duplex
2. High-rise apartment
3. Federal Housing development
4. Condominium
5. Single family high income colonial
6. Middle income apartment house
7. Mobile home
8. Urban estate
9. Inner-city frame houses
10. Stores on bottom, apartments or single family
11. Rooming houses

SLIDES 1-5

Which 3 units are your favorites? Why? 1.____________________

____

2. ____

____

3. ____

____

Which 2 units do you like the least? Why? ____________________

1. ____

____

2. ____

____

How Many Rooms are in each Unit?

Why do you think so? 1. ____________________________

____

2. ____

____

3. ____

____

4. ____

____

5. ____

____

SLIDES 6-11

What kind of job does the person who lives here hold?

6. ________________________________

7. ________________________________

8. ________________________________

9. ________________________________

10. ________________________________

Why do you think so?

SLIDES 6-11

Mark with a #1 the unit that would be most expensive to live in. Mark each until #5, which would cost the least.

11. ____________________________________

____

12. ____________________________________

____

13. ____________________________________

____

14. ____________________________________

____

15. ____________________________________

____

Why did you mark these as you did?

Most: ____________________________________

____

____

____

Least: ____________________________________

____

____

____

Source: Housing in the Urban Environment

3.1.1.2 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the types of industries in Jacksonville so that at least 75% of the students will correctly answer 4 of 5 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Most of the land in north Florida is covered with pine flatwoods. Because of this one of the major industries in Jacksonville is

   a. paper and pulp
   b. steel
   c. sugar

2. An industry in Jacksonville using raw materials imported from Central and South America is

   a. cotton
   b. insurance
   c. coffee

3. A major industry in Jacksonville which uses ground water in its product is

   a. wire and cable
   b. beer
   c. packaging

4. One pine tree product produced by chemical plants in Jacksonville is

   a. tobacco
   b. lumber
   c. turpentine

5. Food is provided for the people of Jacksonville by

   a. the fishing industry
   b. fertilizer plants
   c. banking industry

To the Teacher 3.1.1.2

Industry in Jacksonville

The major industries in Jacksonville are:

1. paper and pulp
2. packaging
3. chemical
4. tobacco
5. coffee
6. beer
7. shipbuilding
8. processing
9. fertilizer
10. cement
11. wire and cables
12. fishing

Student Activity

3.1.1.2
SS

Give student a list of some of the goods produced in the Jacksonville area. Have a supply of newspapers in the classroom. Discuss list of products with class, mentioning how these products are used by businesses and people. Have students, individually or in groups, find newspaper ads for businesses which use these products directly. An example would be that restaurants serve coffee. Students should find at least one ad for each product. The ad selection part of the activity may be done at home. Students should have the opportunity to share with the class the selections they have made.

List of major industrial products:

beer
kraft paper
coffee
wallboard
cement
cardboard boxes
cigars
ships
wire and cable
paint and turpentine products

Student Activity 3.1.1.2
SS

Review with the class reasons for the mass movement of people to cities in this century. Emphasize the importance of "jobs" -- going where labor is needed.

Develop with the class a list of the major industries in your town or city. If several or many industries are identified, divide the class into small work groups with the assignment of researching questions wuch as how many people in the community depend on a specific industry for their living. Why did the industry locate in that particular place? What were (are) some of the good and bad effects of the industry on land, air, water, animals, the town, their family?

Share group findings through reports and class discussion.

Source: 100 Teaching Activities in Environmental Education

3.1.1.3 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the types of commerce in Jacksonville so that at least 75% of the students will correctly answer 4 of 5 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. The tallest buildings in Jacksonville belong to and show the importance to Jacksonville of

   a. hospitals
   b. insurance companies
   c. department stores

2. In business a "service" is

   a. manufacturing process
   b. type of transportation
   c. a useful labor that does not produce a product

3. A major "service" activity in Jacksonville is

   a. medical and health services
   b. window cleaning
   c. telephone repairing

4. A major reason for Jacksonville's growth as a commercial center is

   a. the beach
   b. the number of orange groves
   c. the presence of many types of transportation

5. The flow of money through Jacksonville because of commercial activity has caused a growth in

   a. tourism
   b. banking
   c. farming

Commerce

Jacksonville's industrial activities function within the context of much larger regions; to this end the impact of Jacksonville's industry is felt not only locally, but nationally and internationally as well. One of the largest ports in the Southeast, the City functions as a point of intermediary processing and as a distribution center. In addition to the Atlantic Ocean and the St. Johns River providing natural advantages for water-borne cargo traffic, Jacksonville is provided with interstate highways, I-95 and I-10, to facilitate the efficient movement of goods to regional and national markets by motor freight. The Jacksonville International Airport provides commercial aviation including passenger and air freight service. It is the railroad network, however, which gives the City a distinct advantage over other Atlantic ports in competition for southeastern markets. All mainline railroads serving Florida converge on Jacksonville - the Seaboard Coast Line, the Florida East Coast Railway, and the Southern Railway.

Of the major occupational categories in the private economy of Jacksonville, the services sector has provided the largest increase in employment and payrolls in the period from 1964 to 1971. Medical and health services are the major component of this sector followed by business services and personal services. Retail trade is presently the largest employer in the private economy with 34,000 employers in 1970. While wholesale trade employs about half as many people as retail trade, its payroll is almost equal to retail trade. The number of establishments in the transportation and utilities sector increased more than any other, plus the number of employees surged 42.0 percent. Number of establishments in manufacturing has remained fairly constant with fluctuations being only minor ones. Employment increased around 1966 but has not made significant gains since. Agriculture has been declining since 1968 and mining is almost nonexistent. Employment in contract construction has been rising along with per capital income but the number of firms have declined. Most of the federal employment in the area is made up of civilian employment at naval bases. A total of 34,200 employees are in government jobs on the federal, state, and local level in Jacksonville in 1970. Jacksonville is very important as a regional and statewide financial center. As evidence of this was a 35 percent increase in employment in this sector from 1964 to 1971. The percent of families in Jacksonville with real personal incomes exceeding 10,000 dollars per year increased from 12.4 percent in 1959 to 41.1 percent in 1969. Families with incomes below the poverty level declined in the same period from 21.4 percent of total families to 14.1 percent. The rate of unemployment has been 40 to 50 percent lower in Jacksonville than national or regional rates.

* Filmstrip Set: Man and the Cities, Series I: Economics of the City. Film numbers 3 and 4 should be used with this section.

To the Teacher 3.1.1.3

The Port of Jacksonville

Impact on Growth and Related Problems

The Port of Jacksonville is generally considered to include the 20 mile stretch of the St. Johns River from the Atlantic Ocean to downtown Jacksonville.

Just what does the Port of Jacksonville mean to the community? Well, persons employed directly by waterfront activities number about 22,400 or approximately 10% of our total work force. What does this mean to the remainder of the community? Economists generally theorize that one job creates an additional five jobs in back up services. This means that our waterfront employment profoundly affects the livelihood of some 112,000 wage earners in the City of Jacksonville. This, of course, does not include the impact created by the operation of our Naval Bases. With earnings of $1.87 million and creating an economic impact on the community of nearly $200 million, I believe that you will have to agree that the Port of Jacksonville is big business. It also provides an excellent rate of return on an investment of $25,000,000 in public funds in 1965.

Work of the Jacksonville Port Authority

Construction and improvements to Jacksonville Harbor have cost $12.5 million since the first project was started late in the 1800's. By including maintenance dredging, revetments, and cost of channels, this harbor represents an overall investment of $25.7 million. When the proposed 38-foot channel project becomes a reality, an additional $9 million will be invested in this very active harbor.

With the advent of larger ships to hold increased tonnages, the requirement for channel improvements in the St. Johns River became apparent as early as 1870 when Federal aid was initiated. These initial improvements consisted of dredging to depths generally 15 feet over the entrance bar and 18 feet upstream to Jacksonville. Duval County performed part of this initial work to include some dredging and protective dikes along the river. Succeeding improvements were completed by Federal projects in 1910 (24-foot channel depth); in 1922 (30-foot channel depth); and in 1951 (present 34-foot channel depth). Today's 34-foot channel depth extends from the Atlantic Ocean to Commodore Point. From there upstream other Federal projects have assisted in keeping the St. Johns River navigable to small vessels all the way to Lake Harney, in the vicinity of its headwaters.

The rapid growth of water-borne traffic plying Jacksonville Harbor has continued to flourish. In 1957 the House of Representatives Committee on Public Works passed a resolution calling for a review of the existing project to determine whether additional dredging of the St. Johns River project, Jacksonville to the ocean, was deemed desirable. This review was assigned to the U.S. Army Corps of Engineers, Jacksonville District, and after a 5-year study their findings and proposed recommendations were presented at a public hearing on March 2, 1964, in Jacksonville.

Essentially, the Army Engineers' proposed recommendations were: (1) that Jacksonville Harbor be deepened to 38 feet from the ocean to the vicinity of the municipal docks and terminals, (2) that the channel be made 100 feet wider opposite Sisters Creek, and 200 feet wider opposite St. Johns Bluff, and (3) that existing maintenance depths be continued at 40 and 42 feet at the ocean entrance, and 34 feet from municipal docks to Commodore Point.

The Corps of Engineers study revealed many interesting and noteworthy statistics covering Jacksonville Harbor and the St. Johns River. During the little more than 10 years which have passed since the 34-foot project was completed, water-borne commerce into Jacksonville Harbor has doubled. The study shows this trend will certainly continue, even more so when the 38-foot proposed channel depth becomes a reality.

The Federal improvements to Jacksonville Harbor have been made possible by the City of Jacksonville, Duval County and the Greater Jacksonville Chamber of Commerce providing rights-of-way, spoil areas, and the like required in connection with the project work. Additionally, the City of Jacksonville and private industry have constructed and operate numerous waterfront facilities necessary to handle the increasing water-borne commerce. Some 105 waterfront facilities serve Jacksonville's harbor area, and the City of Jacksonville operates a total of 10 piers, 2 fireboat docks, 5 municipal docks, plus one associated waterfront parking facility. There are some 27 other commercial docks, 23 of which are privately owned and operated and 4 of which are open to the general public. Of these 27 docks, 12 are served with railroad spurs and all have access to Jacksonville's highway and expressway systems. Rail service is also available at 14 of the 15 oil terminals, and there are 5 oil docks operated by the U.S. Navy. This increased volume of traffic has also fostered a number of marine repair facilities, including 20 outfitting piers and drydocks capable of handling large vessels and 12 small craft facilities.

Today the newly organized Jacksonville Port Authority shoulders the responsibility for development of the harbor. Their foresight will assure the city of an active port and a continuing place of prominence in the years ahead.

Operational Statistics for the Jacksonville Port Authority

Marine Division - Cargo Tonnage Report (Short Tons) Fiscal Year

Commodity	1973-74	1972-73	1971-72	1970-71	1969-70
General Cargo Imports					
Coffee	105,504	108,807	103,386	117,325	93,406
Iron or Steel	135,439	130,629	69,278	43,188	50,613
Canned Goods	5,763	9,439	3,249	2,808	3,091
Lumber	63,951	73,969	74,746	71,336	55,061
Autos	136,252	114,659	87,561	108,442	77,350
Plywood	39,424	19,625	8,969		
Tractors	16,834	3,255			
Miscellaneous	43,741	59,136	36,157	17,945	26,257
Totals	546,908	519,519	383,346	361,044	305,778
Auto Units	125,523	108,077	83,698	104,540	74,462
General Cargo Exports					
Linerboard & Paper	234,500	211,503	193,676	278,849	249,987
Clay	3,660	6,151	5,415	1,774	2,107
Scrap Metal	61,766	64,176	36,469	21,883	854
Naval Stores	891	1,999	2,205	1,177	3,073
Woodpulp	8,886	25,144	13,616		
Flour	5,476	8,171	9,694		
Miscellaneous	26,794	52,002	20,523	63,421	63,248
Totals	341,973	369,146	281,598	367,104	319,269
Bulk Cargo Tonnage					
Molasses	18,519	15,711	18,152	19,693	40,462
Petroleum	589,473	654,544	653,827	559,918	501,864
Totals	607,992	670,255	671,979	579,611	542,236

Operational Statistics for the Jacksonville Port Authority (continued)

Commodity	1973-74	1972-73	1971-72	1970-71	1969-70
Containerized Cargo					
Import	25,945	16,749			
Export	64,381	12,438			
Land Transit	1,743				
Totals	92,069	29,187			
Total Tonnage					
Imports, General	546,908	519,519	383,346	361,044	305,778
Exports, General	341,973	369,146	281,598	367,104	319,269
Bulk Cargo	607,992	670,255	671,979	579,611	542,326
Containerized Cargo	92,069	29,187			
Grand Total	1,588,942	1,588,107	1,336,923	1,307,759	1,167,373

Blount Island - "Port of the Future" Now Port of the Present

Thanks to the vision and planning of earlier Port Authority supporters, Blount Island Terminal has at last begun to realize its potential as one of the major deep-water container ports in the Southeast.

Little more than a marsh-riddled spoil dump 10 years ago, Blount Island even then was envisioned as Jacksonville's "Port of the Future", chiefly because of the availability of more than six miles of riverfront for deep water docking facilities and its quick (eight miles) access to the Atlantic Ocean.

In the intervening years, nearly $18 million has been expended to bring the dream to reality, and in mid-1974 JPA Managing Director James J. Scott, Jr., reported that Blount Island indeed has begun paying its own way.

The Puerto Rico Maritime Shipping Authority and the Italian Line joined the Japanese Space Charter Group in designating Blount Island as their container cargo terminal for Southeastern United States.

Their decisions created a need for additional container storage space adjacent to the busy wharf and required the paving of nearly 20 acres of land. Engineering studies also were begun for extending the 3,000-foot marginal wharf another 1,400 feet to the east.

Completion of a new vehicular bridge from the island to Heckscher Drive came just in time to handle the rapidly increasing traffic and two new gantry cranes were pressed into service as soon as they were tested and accepted by the Authority.

The cranes, one with a capacity of 100 tons and the other 50 tons, add substantially to the cargo-handling capability at the terminal which previously had been served by a single 45 ton container crane.

But the increasing emphasis on vehicular containerizations doesn't tell the whole story at Blount Island. The terminal was designated as a ramp point at which both containers and trailers can be loaded and unloaded from rail flat cars at dockside, providing shippers with piggyback service directly from the island without the need for over-the-road transport. And although containerized cargo tonnage jumped spectacularly from 29,100 tons a year ago to 92,000 tons this past year, paper products shipped from Blount Island continued to dominate JPA's list with 234,500 tons, up 23,000 tons from the previous.

Auto imports increased but a sagging economy affected sales and much of the inventory stalled on the island. At times, as many as 15,000 vehicles were parked in long neat rows and hurridly paved storage areas were occupied as quickly as the asphalt had set.

With more and more shippers taking advantage of Blount Island's constantly improving facilities and equipment conveniently located on a 30-foot channel, the Port Authority is turning more attention to attracting industrial development projects on some 500 acres of available prime riverfront property.

Talleyrand Docks and Terminals - Bulging at the Seams

Already taxed for working space, Talleyrand Docks and Terminals is being analyzed carefully to determine where additional room can be found to meet the growing demand for service.

A seven-acre tract north of the Port Central Office Building, site of the old Army Corps of Engineers Dredge Depot, was paved and immediately put into service for auto storage to help alleviate a critical lack of space caused by a slowdown in the movement of vehicles from dockside to dealers.

The terminal now has a total of 65 acres of paved open storage and 617,000 square feet of warehouse space. Another 6.5 acres of critically needed land will become available when the old No. 2 slip is bulkheaded and filled in conjunction with the deepening of the harbor channel to 38 feet.

The Municipal Docks Railway, after being operated at Talleyrand by the JPA and its predecessors for more than 70 years, was turned over to the Seaborad Coast Line Railroad in 1974 under an agreement approved by the Interstate Commerce Commission.

The Authority determined it was not economically feasible to operate the railway at two widely separated terminals and entered into an agreement with the SCL which offered the most financially attractive track-use arrangement received by the JPA.

As soon as the SCL took over, the Authority began razine the old engine house and workshop to provide more working space near the busy Marine Director's office.

More than 88,000 autos were processed at Talleyrand in fiscal 1974, including 20 different kinds of foreign vehicles, most of them the popular compacts. One auto importer solved the space problem and decreased his cost of bringing in pick-up trucks by setting up a plant in a portion of one of the dockside warehouses to assemble truck beds and chassis imported separately at lower import charges.

Although at times Talleyrand appeared literally to be engulfed in autos, such long-time dependable commodities as coffee, steel and lumber continued to move over Talleyrand Docks in large quantities.

Coffee totaled 105,500 tons, iron and steel, 135,400 tons and lumber 63,900 tons; while a couple of comparative newcomers, plywood and tractors, had tonnages topping 39,400 and 16,800 tons, respectively.

Talleyrand's two major tenants, Sea-Lane Services, Inc., and Joyserv continued to record increased tonnages over the docks which they lease from the Authority. Sea-Land moved nearly 58,000 containers with a total weight of 930,300 tons and Joyserv, a subsidiary of Southeast Toyota Distributors, Inc., imported and processed 55,490 vehicles.

With the help of these fine businesses and the many others which chose to move their commodities through Jacksonville Harbor, the Port of Jacksonville continued to lead the entire State of Florida in total dollar value of general cargo imports ($606.3 million) and was second only to Tampa in total tonnage handled (15.5 million) in calendar 1973, according to figures compiled by the U.S. Department of Commerce and the Army Corps of Engineers.

Looking Ahead

The future projects in which the Port Authority is especially interested include:

1. Completion of the 38-foot Harbor Deepening Project to Mile 20. Of the remaining federal cost of this project, estimated at $10,996,000 by the U.S. Army Corps of Engineers, $6,260,000 has been appropriated for Fiscal Year 1975, leaving $4,736,000 needed to complete the entire project.
2. Continuation of necessary maintenance dredging of the entire Jacksonville Harbor Channel, including elimination of a backlog of maintenance dredging work presently estimated at $1 million. A total of $865,000 in federal funds has been appropriated for maintenance dredging in F/Y 1975.
3. Initiation of a study of the need for a new project to deepen the Jacksonville Harbor Channel to 45 feet. This study was authorized in July, 1968, but has not been funded.
4. Completion of the St. Johns River Model Study aimed at solving the problem of excessive silting in the Mill Coverarea and other problems which are prevalent in the upper 50-mile stretch of the river. The entire project is estimated to cost $641,000, of which $216,000 is the estimated cost of the Mill Cove study portion. For F/Y 1975, $162,000 has been appropriated for the Mill Cove study, leaving approximately $54,000 required to complete the Mill Cove portion of the study.
5. Widening of the ship turning basin adjacent to the harbor channel

at Blount Island. A report on this project has been completed and is under review by the Corps of Engineers. Subject to approval of the detailed project, a report can be completed by early 1976, according to the Corps of Engineers. The cost would be included under the small project authority.

The tankers using the Jacksonville harbor were built during the World War II era. They are capable of carrying approximately 150,000 barrels or 20,000 tons of oil. An additional four foot channel depth will almost double the ship's capacity to 300,000 barrels or 40,000 tons.

The major factor in additional harbor depth is that the larger ships (40,000 tons) are more available than the smaller ships (20,000 tons). Factor: 1/2 the present number of tankers will be required.

Factor: There will be an estimated savings of 20%.

At present, the larger tankers which enter the Jacksonville Harbor, light loaded, pay the same rate they would if they were full. Insurance rates are also paid as if the vessel were full. The age of the ship determines the scheduled insurance rates. Newer ships are using a better pumping system than the older ships which used steam pumps, causing many leaks from loose fittings and vibrations.

Student Activity

3.1.1.5
A,SS,LA

Have students bring newspapers to school several days before undertaking this activity. Divide class into 4 or 5 groups. Give each group a newspaper and scissors. Ask each group to locate and cut out as many different examples of commercial activity as they can find. From these make a general list of these commercial activities on the board. (Point out on which have been overlooked.)

Each group is to use clippings to make a collage, bulletin board, etc., symbolizing commercial activity in Jacksonville.

3.1.1.4 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the types of transportation serving Jacksonville so that at least 75% of the students will correctly answer 4 of 5 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Jacksonville is the major railroad center in Florida because

    a. it has interstate highways
    b. we have railroad bridges
    c. all mainline rail lines in Florida meet in Jacksonville

2. The Jacksonville International Airport is able to handle

    a. passenger and freight service
    b. only passenger service
    c. only freight service

3. The major use of the Port of Jacksonville is for

    a. tourism
    b. commerce
    c. passenger liners

4. Automobile travel through Jacksonville is made easier because of

    a. the expressway system
    b. traffic lights
    c. winding streets

5. The only area in Jacksonville adequately served by city buses is

    a. the suburbs
    b. downtown
    c. the beaches

Transportation

Jacksonville's industrial activities function within the context of much larger regions; to this end the impact of Jacksonville's industry is felt not only locally, but nationally and internationally as well. One of the largest ports in the Southeast, the City functions as a point of intermediary processing and as a distribution center. In addition to the Atlantic Ocean and the St. Johns River providing natural advantages for water-borne cargo traffic, Jacksonville is provided with interstate highways, I-95 and I-10, to facilitate the efficient movement of goods to regional and national markets by motor freight. The Jacksonville International Airport provides commercial aviation including passenger and air freight service. It is the railroad network, however, which gives the City a distinct advantage over other Atlantic ports in competition for southeastern markets. All mainline railroads serving Florida converge on Jacksonville - the Seaboard Coast Line, the Florida East Coast Railway, and the Southern Railway.

The analysis of thoroughfares and mass transit focuses upon the complementary strengths and weaknesses of two modes. Transit facilities best serve the central business district, where travel demands are intensely concentrated into a small area. On the other hand, only a small proportion of the total number of auto trips begin or end at the central business district. New highways through developed areas would be much more disruptive than new transit lines would be. In light of this analysis, new highways are recommended to be primarily circumferential; i.e., that they go around rather than through developed areas. Radial travel demands should be satisfied by a combination of existing highways with radically improved rapid transit facilities.

Commercial aviation facilities were reviewed and found to be generally satisfactory. They are focused upon Jacksonville International Airport, which is only about five years old. General aviation facilities were found to be deficient in that neither of the two existing facilities which primarily serve general aviation is suitably located to provide the instrumentation and runway length needed by general aviation jet aircraft. Construction of a new general aviation facility is recommended.

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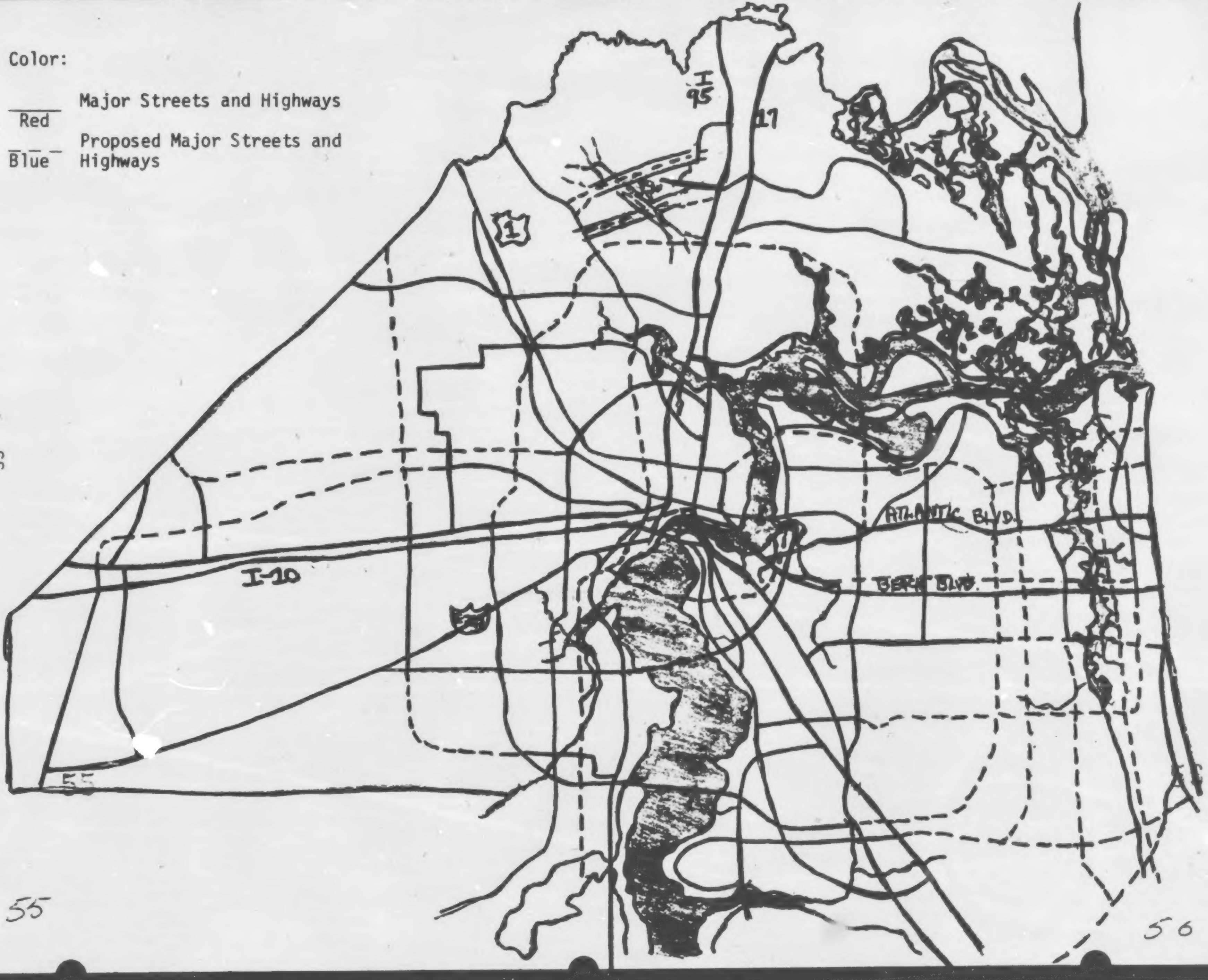
* Filmstrip Set: Man and the Cities, Series I: City Problems and Alternatives - film 1 should be used with this section

3.1.1.4
SS

Student Activity

Color:

___ Red	Major Streets and Highways
_ _ _ Blue	Proposed Major Streets and Highways


I
95
17
1
I-10
295
ATLANTIC BLVD.
BEACH BLVD.
55

Student Activity

3.1.1.4
MA, SS

Things on Wheels

1. Count the things on wheels that pass by in ten minutes. Do this at three different times in the school day.
2. Show in some way, which period was the busiest. Suggest why this was so.
3. Show on a graph which kind of wheeled things were most common.
4. Find out how many wheeled things would pass by in one day.
5. Are the results the same for all streets? What pattern did you notice?

Source: Ecolab

Student Activity

3.1.1.4
MA, SS

Observing a Bus Route

1. Find out how often the bus goes by during the day. Find out if this time ever changes.
2. Observe the bus for a period of time through the day. Count the number of people on the bus each time it passes.
3. What patterns do you notice? Tell your classmates about the patterns by using a graph or some other means.
4. Try to explain the patterns.

Source: Ecolab

Student Activity

3.1.1.4
MA, SS

Passenger Car Traffic Flow

Ask the class to work in teams of two to collect data on the number of passengers riding in automobiles that are going different directions across a busy intersection. Record the number of passenger automobiles carrying only one, two, three, four, or more passengers. Record either for a specified time or until a certain number of cars, such as 100, have been recorded. Ask each team to calculate percentages of cars with different numbers of passengers. If possible, repeat at a significantly different time of day.

In class, have each group enter its data into a large table for the purpose of developing a more reliable sample and sounder conclusions.

Discuss questions such as: Does direction of traffic flow seem to make a difference? Why? Does time of day make a difference? Were you surprised at the results? Did you get evidence to support the idea that people are forming car pools to save gasoline?

Source: Teaching Activities in Environmental Education - Volume II

3.1.1.5 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the uses by government of land in Jacksonville so that at least 75% of the students answer correctly 4 of 5 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. The Federal Government owns large tracts of land in Duval County for use by

   a. the FBI
   b. the Internal Revenue Service
   c. the Navy

2. Over 125 public schools in Jacksonville are owned by

   a. the city government
   b. the federal government
   c. the state government

3. In Duval County, the federal government, the State of Florida and the City of Jacksonville all own and operate

   a. parks and recreation areas
   b. telephone systems
   c. military bases

4. Streets and highways take up large areas of land in Duval County. These streets and highways are

   a. owned by industrial companies
   b. publicly owned
   c. owned by the people who live on the street

5. Large areas of land in Duval County are set aside by government for

   a. farms
   b. mining purposes
   c. wildlife refuge and conservation

Government

In Duval County the Federal Government maintains four military areas: Mayport Naval Air Station, the Jacksonville Naval Air Station, Cecil Field Naval Air Station and Whitehouse Field. Other federal facilities include the Postal Service, Fort Caroline National Park, judicial system and many other federal agencies located in the Federal Building.

State land use includes:

- Guana River Wildlife Refuge
- Nassau Wildlife Management Area
- State Parks
  - Katherine Abby Hanna
  - Little Talbot
  - Fort Clinch
  - Fort George
  - Tree Hill
- Cary State Forest
- Educational Institutions
  - Florida Junior College
  - University of North Florida
- State and Interstate Highways

Use by Consolidated City of Jacksonville:

- Public Schools
  - There are presently 115,000 students in grades K-12 in the public schools of Jacksonville.

Parks and Recreation

Jacksonville's current public park and recreation area inventory indicates 370 facilities encompassing 5,500 acres.

County Buildings

These buildings house such governmental agencies as

- hospitals and health facilities
- libraries
- Court House
- City Hall
- fire stations

Port Authority

- Tallyrand docks and terminals
- Blount Island
- Airports

Utilities

- Water and sewer
- Jacksonville Electric Authority

Roads

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* Filmstrip Set, Man and the Cities, Series 1, Economics of the City. Film 6 should be used with this section.

Student Activity

3.1.1.5
SS,LA

Show filmstrip, "Cities Need Services", from the series Man and the Cities, Series I: Economics of the City. As students view filmstrip have them list the types of services shown. When viewing is completed make a composite list on the board, calssifying the services as either public or private. Have copy made for each child or have them copy master list from board. Give each student the page from the telephone book which contains the "Jacksonville, City of" listings. This listing will contain major divisions of city government. Using the list from the board and the phone book page have children match city government division that will provide each listed service. Example: playgrounds - Recreation.

Examples of Services

Public	Private
Crossing guard	Nurses
Buses	Markets
Playgrounds and parks	Mail
Police	Phone
Signal lights	Taxi
Fire	
City Hall	
Garbage	
Water	
Electricity	
Roads	

Student Activity

3.1.1.5
SC,LA

JACKSONVILLE CITY OF

For listings of State of Florida Government departments and agencies, see "Florida—State of"
For listings of United States Government departments and agencies, see "United States Government"
Governments Services are listed alphabetically by organization

NOTE: MANY DEPARTMENTS OF CITY GOVERNMENT MAY NOW BE DIALED DIRECTLY. CONSULT LISTINGS BELOW FOR PROPER DEPARTMENT AND TELEPHONE NUMBER.

FREQUENTLY CALLED NUMBERS

ALCOHOLIC REHABILITATION CENTER
  1245 Jesse ---------633-2834
AMBULANCE SERVICE
  To Request Emergency
    Ambulance Service----633-2211
ANIMAL CONTROL CENTER
  338 Margaret ---------633-5480
  Saturday & Sunday call-633-5480
AUDITORIUM TICKET INFORMATION -------- 633-2900
AUTOMOBILE INSPECTION OFFICE ------------- 633-5502
AUTOMOBILE TAGS-See Tax Collector
BUS SCHEDULES ---------354-7881
CITY ATTORNEY City Hall--633-2460
COLISEUM TICKET INFORMATION -------- 633-2900
CONSUMER AFFAIRS
  City Hall ------------633-3[illegible]40
CONVENTION BUREAU
  Hemming Park --------353-9730

DEAD ANIMAL PICK UP----633-2434
DOG POUND-See Animal Control Center
DOG WARDEN
  See Animal Control Center
DRIVERS LICENSES--See Fla State Of
DRUG REHABILITATION
  Jax House ------------633-2566
ELECTRIC AUTHORITY
  Loss of Power-Repair Service
    24 Hour Service-----633-5310
FIRE—To Report A Fire---633-2211
GARBAGE COMPLAINTS
  Inner-City Complaints --633-2434
  Suburban Complaints ---633-3045
GATOR BOWL TICKET INFORMATION -------- 633-2900
  Game Day &
    Emergencies ----- 633-2979
HIRING --------See Personnel Dept
JACKSONVILLE COMMUNITY RELATIONS COMMISSION ------- 633-2010
  Rumor Control Line---633-2296

JACKSONVILLE ELECTRIC AUTHORITY
  Loss of Power-Repair Service
    24 Hour Service-----633-5310
JAIL INFORMATION ------633-4350
JAX HOUSE
  Drug Rehabilitation ----633-2566
LIBRARIES-----See Libraries Public
MOTOR VEHICLE INSPECTION OFC ---------------- 633-5502
POLICE DEPT-OFC OF THE SHERIFF
  Emergency Calls -------633-4111
  Information ---------- 633-4202
  Victim's Advocate -----633-4340
  All other calls
    See Listings Below-Sheriff's Office
PUBLIC RELATIONS
  Information Services ----633-2500
RECREATION
  See Recreation & Public
    Affairs Dept
RUMOR CONTROL CENTER
  24 Hours ------------633-2296

SCHOOL BOARD---See Schools Public
SEWER PROBLEMS -------633-2930
  Note: 12 am until
    7:30 am -----------633-4969
UNIVERSITY HOSPITAL OF JACKSONVILLE ------- 358-3272
UTILITY REGULATORY BOARD
  128 E Forsyth --------633-3045
VETERANS SERVICE OFC
  Courthouse ---------- 633-2020
WATER & SEWER BILL INFORMATION -------- 633-2880
WATER PROBLEMS -------633-2940
  Note: 12 am until
    7:30 am -----------633-4969
WELFARE DIV
  Intake Applications—
    962 Main ----------633-2600
  District Social Workers—
    962 Main ----------633-2680

Conceptual Scheme for Ecology of a City

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

Part I: The City is....

- 3.1 Resources in an urban ecosystem
    - 3.1.1 The ways land is used in the city
        - 3.1.1.1 The types of housing in the city
        - 3.1.1.2 The types of industries in Jacksonville
        - 3.1.1.3 The types of commerce in Jacksonville
        - 3.1.1.4 The types of transportation serving Jacksonville
        - 3.1.1.5 The uses by government of land in Jacksonville
    - 3.1.2 How man affects urban air
        - 3.1.2.1 The kinds and sources of urban air pollutants
        - 3.1.2.2 How cities make their own weather
    - 3.1.3 The importance of ground and surface water to the City of Jacksonville
        - 3.1.3.1 The supply, distribution and use in the city of ground water
        - 3.1.3.2 Characteristics and function of surface water in the city
            - 3.1.3.2.1 The characteristics of the St. Johns River
            - 3.1.3.2.2 The functions of surface water in the City of Jacksonville
    - 3.1.4 To recognize urban plants and animals, their habitats, food and adaptations
        - 3.1.4.1 To recognize urban plants, their habitats and adaptations

- 3.1.4.1.1 Some of the urban plants are cultivated by man
- 3.1.4.1.2 Some urban plants are volunteers
- 3.1.4.2 Urban animals, their habitats, food and adaptations
- 3.1.5 The sources and kinds of energy used in Jacksonville

Part II: The City Should Be....

- 3.2 Man must use planning to bring about controlled change
  - 3.2.1 The ways man may control the quality of air, water and land
    - 3.2.1.1 The ways man may control the quality of air
    - 3.2.1.2 The ways man may control the quality of water
    - 3.2.1.3 The ways man may control the quality of land
  - 3.2.2 The factors of an urban environment which may disturb man's sensibilities
  - 3.2.3 Planning is required to make the needs of the people in an urban ecosystem compatible with their environment
- 3.3 Man lives in a complex system of interlocking factors none of which can be changed without affecting the others

3.1.2 IPO Criterion Test

For intermediate grade students of environmental studies to develop an awareness of how man affects urban air so that at least 75% of the students studying urban air will correctly answer 8 of 10 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. The amount of pollution in the air is affected by
    a. noise level
    b. wind and rain
    c. position of the moon
2. Pulp and paper mills are a problem to Jacksonville because
    a. they cause unpleasant odors
    b. they hire many people
    c. trees are a raw material
3. A city is warmer than the surrounding countryside because
    a. buildings and streets soak up heat
    b. the sun's rays are hotter
    c. there are more trees
4. High levels of ozone in the air may cause
    a. thunderstorms
    b. respiratory problems
    c. skin cancer
5. An odorless poisonous gas which may build up in unventilated cars is
    a. nitrogen
    b. oxygen
    c. carbon monoxide

6. The air in Jacksonville is often polluted because

   a. the things people need often lead to air pollution
   b. people do not care if the air is polluted
   c. too many people are breathing the air

7. Pollution is a combination of

   a. poisonous gases and particulates
   b. oxygen and carbon dioxide
   c. rainfall and carbon

8. Movement of air helps prevent

   a. thundershowers
   b. thermal inversions
   c. heat waves

9. Air pollution in Jacksonville is greatest

   a. in the suburbs
   b. around airports
   c. along the river

10. In cities a great amount of particulates enter the air from

   a. sewers
   b. automobiles
   c. hospitals

3.1.2.1 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of the kinds and sources of urban air pollutants so that at least 75% of the students studying urban air will correctly answer 7 out of 8 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Unpleasant odors from paper mills and chemical plants are caused by
   - a. carbon monoxide
   - b. oxygen
   - c. sulphur oxides
2. Plants are damaged when the air contains large amounts of
   - a. carbon dioxide
   - b. ozone
   - c. oxygen
3. The worst danger from air pollution is the danger to
   - a. health
   - b. buildings
   - c. house plants
4. Which industry in Jacksonville puts the most particles and odor in the air?
   - a. pulp and paper
   - b. insurance
   - c. tobacco
5. The most harmful things in the air are
   - a. solar rays
   - b. gases you cannot see
   - c. odors that make you feel sick

6. Which of these workers probably breathes the most pollution from the air each day at work?

   a. toll collector on a busy bridge
   b. factory worker at the coffee plant
   c. school teacher

7. The incomplete burning of gasoline and oil produces

   a. hydrocarbons
   b. oxygen
   c. fertilizer

8. A stinking brown haze that irritates the eyes and nose is caused by

   a. carbon monoxide
   b. oxygen
   c. nitrogen oxides

The Growing Threat of Dirty Air

Cities have tried very hard to wipe out disease. Mostly they have been worried about sickness caused by bacteria and viruses. Now there is a new danger to city health--the danger from air pollution.

Actually, air pollution is not new in cities. At least one city has had it for hundreds of years. In 1306 the city of London got so smoky that laws had to be passed to stop the burning of certain kinds of coal. In most cities, however, the problem of air pollution has become much worse in the last few years. Today Americans release over 200 million tons of pollutants into the air each year. In the five years from 1965 to 1970, the amount increased by 58 million tons, and it is still climbing. Every day a person must breathe 15,000 quarts of air to stay alive. If a person is breathing in certain parts of New York City, he will take in as much pollution from the air as he would get from smoking 38 cigarettes.

Air pollution comes from many places. The list at the side of the page shows some of the largest sources. In a city where many kinds of pollutants pour into a small amount of air, pollution sometimes gets very strong. Sometimes certain weather conditions over the city can make it worse.

Pollution can get so strong in cities that it can eat away the stone of buildings and the metal of statues. It can cause paint to peel and some kinds of cloth to dissolve. Only a few kinds of trees can grow along busy city streets because of pollution.

The damage to American cities from air pollution runs into millions of dollars a year. But by far the worst danger from air pollution is the danger to health. Air pollution can cause many kinds of lung diseases, perhaps including cancer. When pollution gets bad, it may kill people who are old or weakened by other diseases.

Two Cities Visited by Killer Smog

The small city of Donora lies in a valley in western Pennsylvania. Donora has built many industries, including a steel mill and a plant that purifies zinc ore. On October 26, 1948, a layer of warm air lay above the mountains on both sides of Donora. But in the valley, the air was cool. The chimneys of the mills and factories poured smoke into the cool air. In that smoke was a gas called sulfur dioxide, which is poisonous to people if they breathe too much of it.

For three days, the layer of warm air covered the valley like a lid and sealed in the cool air beneath it. As the sulfur dioxide increased, the people of Donora found it harder and harder to breathe. Then people began to die. At the end of three days, 20 people were dead. Most of them already suffered from lung and heart trouble, and the sulfur dioxide had been too much for their weakened bodies.

The worst city air pollution ever known happened in London, England, in 1952. A layer of cool, foggy air settled over the city on December 4th. For six days, the air did not move. Chimneys and automobile exhaust pipes poured pollutants into the air. The fog turned into a dark gray mixture of fog and smoke that scientists call smog. The smog became so thick that people could barely see to move around. The smog even seeped into houses through cracks around doors and windows. By the end of the sixth day, hospitals were full of patients who were made sick by the pollution. During that week and in the few weeks after, 4,000 people were killed by the smog. As in Donora, most of these were people who had weak hearts or bad lungs.

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* Filmstrip Set, Man and the Cities, Series 1, City Problems and Alternatives, Film 3

Student Activity

3.1.2.1
Sc, Ss, La

Air Facts

We don't think much about breathing because breathing is done automatically by our bodies. Look at a watch or a clock with a second hand. Breathe naturally. Count how many times you inhale in a minute? Write the answer here.

____

Now find out how many times you inhale in a day. (hint) How many minutes are there in 24 hours (one day)? ____________

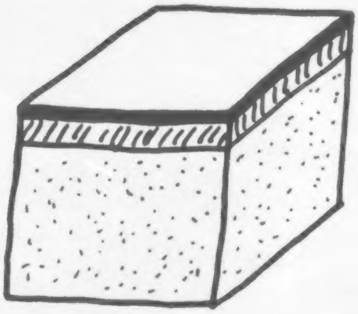
How many times would you inhale in one day?

____

You can begin to see how important the air is. Without air we could not exist... you must breathe air continually to survive.

Every person breathes about 35 pounds of air each day. The same air must be used over and over again by all people on the earth.

All life on earth depends upon a thin layer of air. This layer is about eight miles thick. That may sound like a lot of air spread over the surface of the earth, but it is really a very small supply. To see how little it is, think of the Earth as being the size of an apple. The layer of air we can use around the earth would then be even thinner than the apple's skin.



Air is a mixture of gases. About 78% of the air is nitrogen, 21% is oxygen, and 1% is a mixture of argon, carbon dioxide and other materials. Air also contains water vapor, but the amount is different from day to day.

Look at the drawing to the left. Label which part of the air is nitrogen, which part is oxygen, and which part is the other materials.

Student Activity

3.1.2.1.

SC,SS, LA

The Problem

You can see how we depend on clean air, and yet in the United States we pollute our air with materials that are dangerous to life.

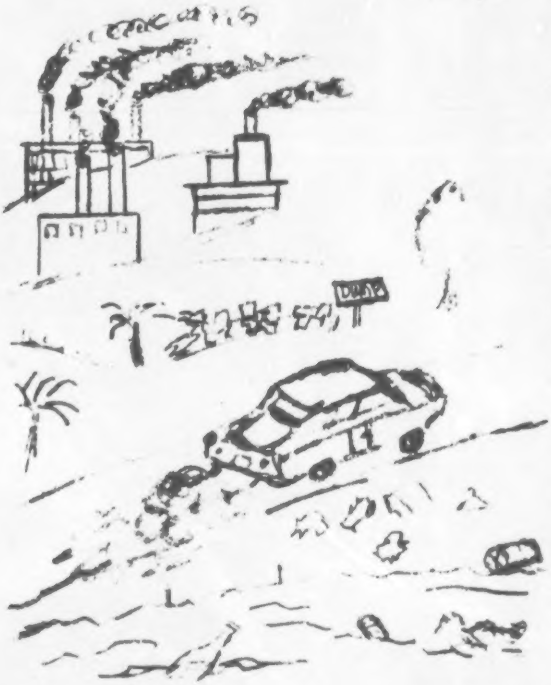
Long ago, the air carried only natural things: moisture that turned into rain; dust blown up by the wind; pollen and seeds from plants. There was smoke from people's fires, but not enough to darken the sky.

Now the air around us is sometimes thick with pollution. Dirt and soot, poisoned fumes and gases are bad for everyone who breathes them. Polluted air hangs over many towns and cities and darkens whole valleys.

WHY do people do this to their environment? Write what you think here.

____

____



The things people need often lead to air pollution.

People need electricity, but the coal or oil burned to make electricity pours smoke into the air.

People need factories to make things to wear and use and enjoy. But factories often send smoke and dangerous fumes and chemicals into the air.

People need cars. But every moving cars sends fumes out the exhaust pipe. The air is full of pollution from cars, trucks, and buses.

People need to get rid of their garbage and wastes. In many places, people burn their wastes. Clouds of soot and smelly fumes pour into the air. The smells in the air are unpleasant, but they do not hurt you.

Student Activity

3.1.2.1
SC,SS, LA

The Dirty Guys

There are things in polluted air that are dangerous to you and to your environment.

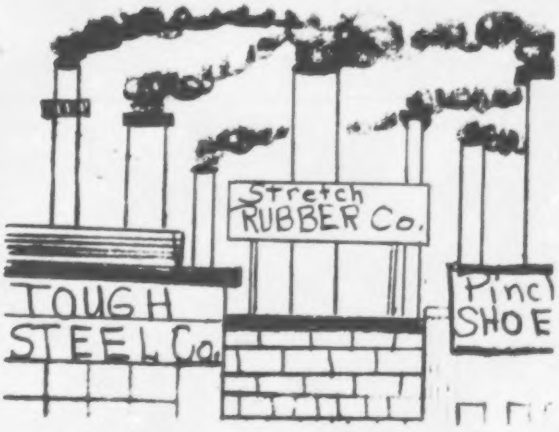
CARBON MONOXIDE This is a poisonous gas that comes from cars as they burn gasoline. You cannot see or smell this gas. Large amounts can kill; small amounts can cause dizziness, headaches, and fatigue. It slows down a person's ability to think and move fast. It is most dangerous for people with heart disease or lung problems.

You often find the highest levels of carbon monoxide around areas of heavy traffic that is not moving very fast. Also in a closed area like an underground parking lot or a tunnel.

1. Would a person know if there was carbon monoxide in the air he was breathing?

__________ Why? ______________________________

2. Can you think of a place where you have been where there was probably a lot of carbon monoxide in the air? __________________ Would you want to stay in this place long? __________________



SULPHUR OXIDES These poisonous gases come from factories and power plants. Power plants are the worst sulphur oxide polluters in Jacksonville.

The sulfur dioxide which forms is a colorless gas that has such a bad smell that a person breathing it may believe he is being choked.

Sulphur dioxide in the air irritates the eyes, nose and thoart and damages the lungs. It kills plants, rusts metal, and makes it difficult to see things at a distance.

1. How does the poisonous gas, sulphur dioxide, get into the air? __________

____

2. If sulphur oxides are dangerous, why don't we close down the power plants that are putting them into the air? ______________________________

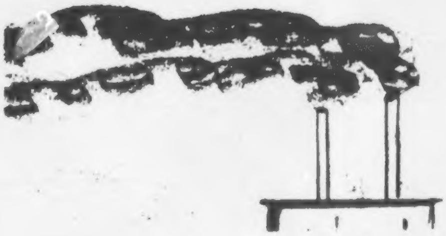
3. Name three ways sulphur dioxide is harmful. 1) ______________________

2)______________________ 3)______________________

Student Activity

3.1.2.1
SC,SS,LA

...more dirty guys



NITROGEN OXIDES Another gas produced by burning fuels which change nitrogen and oxygen to nitrogen dioxide. Nitro oxides cause a stinking brown haze that irritates the eyes and nose. It shuts out sunlight and destroys the view.

1. Where does nitrogen oxide come from? ____________________
2. What two gases are changed to nitrogen dioxide? ____________________
3. Do you think Jacksonville has any nitrogen dioxide in its air? __________

HYDROCARBONS Hydrocarbons are chemicals that contain carbon and hydrogen.

The main sources that pollute air are burning coal and gasoline. When these fuels are burned, often the burning is incomplete. The unburned chemicals in combustion are released into the air from cars and factories. In the air they produce smog.

Experts believe hydrocarbons are a cause of cancer.

1. Another word for burning is ____________________.
2. In the air, hydrocarbons produce ____________________.
3. Would you like to live and play in a city with a smog problem? __________.
4. Why do experts think hydrocarbons are so dangerous to health? __________.

... and more dirty guys

PARTICULATES Smoke, fly ash, dust, etc. are solid particles in the air. Some are natural and some are man-made. The larger the particles, the more quickly they settle to the ground. Smaller particles may stay in the air for long periods of time.

Particles in the air soil clothes and buildings. They carry poisonous gases to the lungs. They come from automobiles, fuels, building materials, fertilizers, etc. In Jacksonville, the paper mills produce a great amount of particulates.

1. Particulates are ________________ ____ ______________ in the air.

2. Write two reasons why it is bad to have particles in the air.

   1) ______________________________ 2) ______________________________

3. Which industry in Jacksonville puts many particulates into the air?

   ____

PHOTOCHEMICAL SMOG Photochemical smog is a mixture of gases and particles. The sunlight combines the gases that are released in burning fuels (nitrogen oxides) with unburned chemicals from cars (hydrocarbons) to make ozone.

Ozone irritates the eyes, nose and thoart and makes breathing difficult. They damage plants and materials.

1. Another word for photochemical smog is ______________________________.

2. List three harmful effects of ozone. 1) ______________________________.

   2) ________________________. 3) ______________________________.

Student Activity (cont.)

TEST YOURSELF ...... You can look back!

1. The two gases that make up most of our air are:

   a. carbon dioxide and smog
   b. nitrogen and oxygen
   c. carbon dioxide and nitrogen

2. Why is the air in the United States so poluted?

   a. because people do not care if their air is polluted
   b. because the things that people need often lead to air pollution
   c. because there are too many people breathing the air in the United States

3. Unscramble these words to find the six pollutants in the air.

   SELICTARPAT ____________________

   NOCORDAYHSR ____________________

   HOTPICHOMACEL GMOS ________________

   DEOMINOXCOBNAR __________________

   ROBINNETSEDIOX __________________

   SSHOXLEIRUDUP ___________________

4. Put each of the six items above under the correct column. (hint) Not every line will be used.

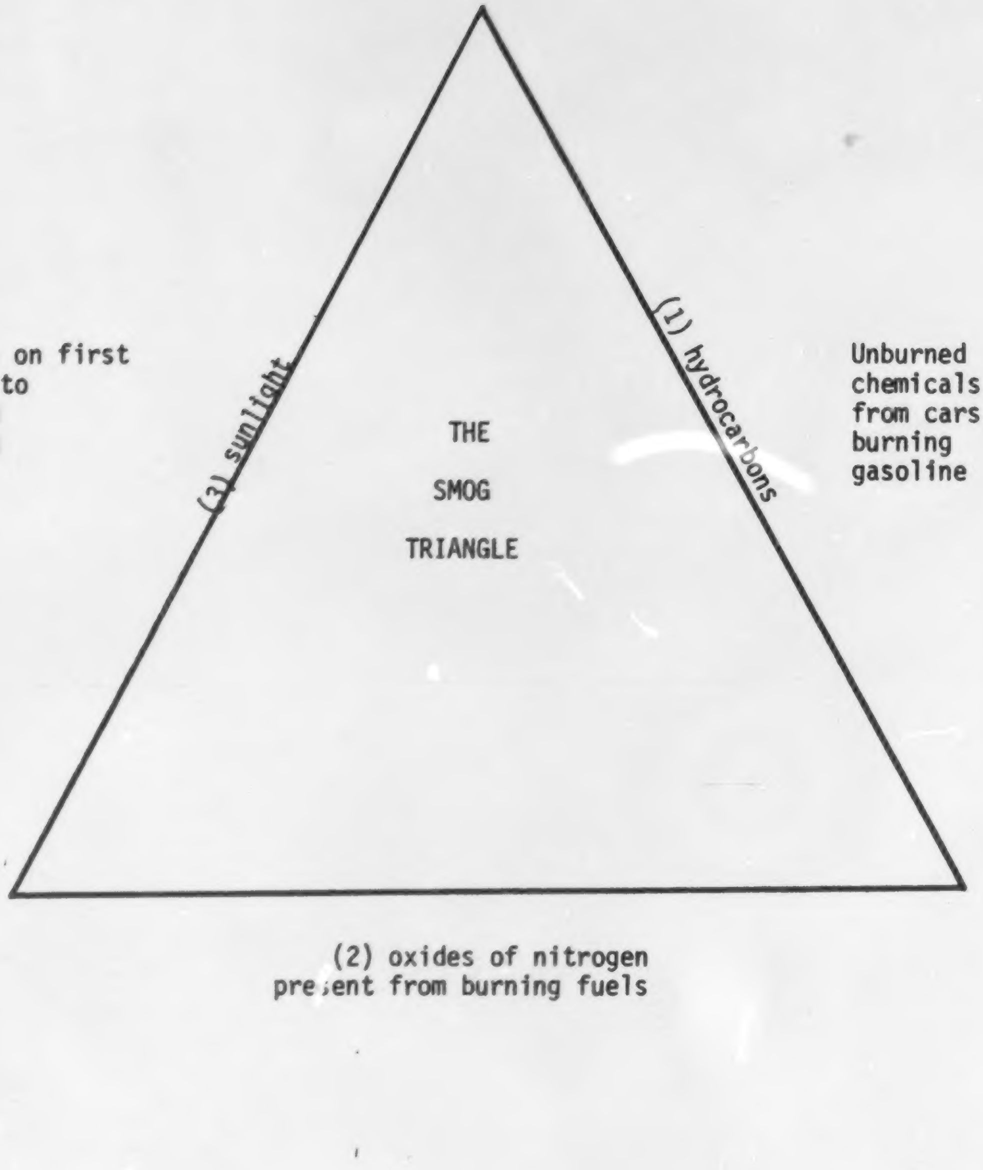
gas	chemical	solid

Student Activity

3.1.2.1
SC

How to make "photochemical smog"

Acts on first
two to
form
smog


(3) sunlight
(1) hydrocarbons
THE
SMOG
TRIANGLE

Unburned
chemicals
from cars
burning
gasoline

(2) oxides of nitrogen
present from burning fuels

Student Activity

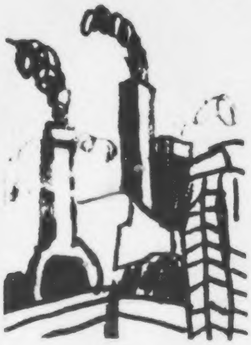
3.1.2.1
SC,SS,LA

Who Did It?

Cars are the biggest source of air pollution. At the present time about 51% of air pollution comes from the exhaust of motor vehicles. The number of automobiles in the United States is growing faster than at any other period since they were invented.

Most of the pollutants come from the car's exhaust pipe. The exhaust consists of a mixture of carbon dioxide, carbon monoxide, unburned hydrocarbons, water vapor, nitrogen oxides and other products of combustion.

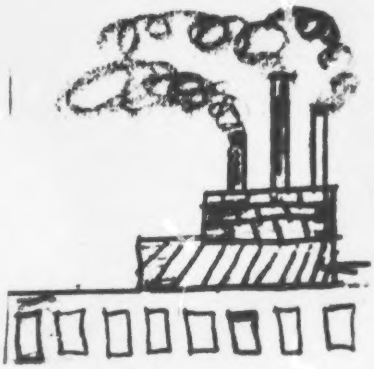
The opinion of air pollution experts is that the only way to solve the problem to invent a new kind of engine that does not pollute the air when fuel burns.



Industry is the second biggest source of air pollution. The industries that create the worst pollution are one that deal with metals, oil refining, chemicals, fertilizers, and pulp and paper.

In Jacksonville, the paper industry has mills that give off bad odors which are hard to control, along with particles that remain suspended in the air.

Electric power plants are the third biggest cause of air pollution. There are three ways of making electrical power today:
1) burning of fossil fuels (coal and oil)
2) water power
3) nuclear power
Most of the plants today use fossil fuels as an energy source. In Jacksonville, the electric power plant uses oil. Nuclear energy is the newest of the sources. Jacksonville plans to have a nuclear plant offshore by 1980.



Student Activity (cont.)

Space heating is the fourth source of air pollution. Even though heating puts only 6% of the total air emmissions of the five major pollutants. In large, crowded cities space heating can cause more air pollution than industry. In a city the effect of space heating is much greater than in more open areas.

The fifth cause of air pollution is the burning of trash and garbage. In the United States there is so much garbage that it would surprise almost everyone. The most popular way to get rid of this solid waste is to burn it. Many cities ahve huge incinerators to burn all the garbage collected. Sometimes instead of an incinerator, large dumping grounds are used and the trash is burned out in the open. All of this burning creates an abundance of air pollution.

Number the sources of air pollution below. The biggest polluter should be numbered 1, the second biggest polluter 2, etc.

________ burning trash and garbage

________ industry

________ space heating

________ automobiles

________ electric power plants

Student Activity

3.1.2.1
LA,SC

Vocabulary

carbon dioxide	a colorless, odorless gas made of carbon and oxygen; produced by the life processes of animals, by the decay of organic materials, and by certain chemical reactions
carbon monoxide	a colorless, odorless gas made up of carbon and oxygen; produced by the imperfect combustion of hydrocarbons; poisonous to plants and animals, including man.
combustion	burning
conservation	helping to stretch, not waste, the Earth's resources
emissions	pollutants produced by automobiles and industry
hydrocarbons	compounds of hydrogen and carbon; produced by incomplete combustion
hydrogen	a colorless, gas element
internal combustion engine	an engine in which power is produced by burning gasoline
land breeze	a soft wind blowing usually at night toward the sea from the more rapidly cooling land.
nitrogen	a colorless, tasteless gas element; forms most of the earht's atmosphere; an important element for plant and animal life.
nitrogen oxides	combinations of nitrogen and oxygen; most nitrogen oxides are harmful to plants and animals
oxygen	a colorless, odorless, tasteless gas element; forms about one-fifth of the earth's atmosphere and combines with most elements
ozone	a colorless gas with a peculiar odor; poisonous to plants and animals
particles	small pieces or bits of a substance, usually separated from the point of origin

Vocabulary con't.

pollutant	any substance which fouls, contaminates or makes less pure any other substance, adding unneeded or unbalancing matter to the environment
sea breeze	a cooling gentle wind blowing inland from the sea, usually in the daytime
smog	a combination of sunlight, imperfectly-burned hydrocarbons, nitrogen oxides and particles which can cause eye irritation and damage to health and property
sulphur dioxide	a chemical made up of sulphur and oxygen, usually in the form of a gas which is poisonous to plants, animals, and man.
thermal inversion	occurs when a layer of warm air forms over cooler air near the ground, and acts like a lid to keep the cooler air from rising

Student Activity

3.1.2.1
SC,LA

HOW CAN AIR POLLUTION HARM YOU?

Experts say that our dirty air is costing the United States more than $12 billion a year!

How many ways can you think of that dirty air costs money? Your list may begin with:

1. Dirty air harms the vegetables growing on farms.
or
1. Cars have to be washed more often.

Try to list eight.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________

Now compare your list with the transpariencies. Did you think of any that are not listed on the transparencies? _________.

What do you think is the worst thing about air pollution?

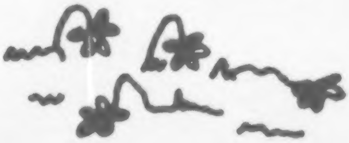
____

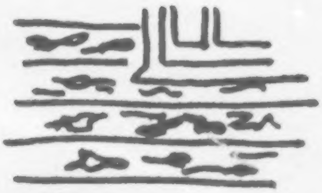
Student Activity

3.1.2.1
SC,LA

Dirty Air Costs

Pollution affects crops, flower gardens, trees, parks, fruit orchards, grains for cattle, cotton, and tobacco.





Polluted air causes paint to discolor and peel

Dirty air damages materials. Clothes, cars, homes, buildings have to be washed more often.

Cattle are poisoned

Metals rust 2 to 4 times faster in air-polluted cities

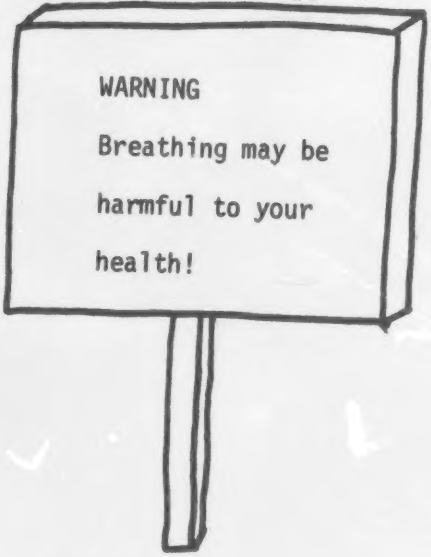
Dirty air makes rubber crack.

Incomplete combustion in factories wastes fuel

Dirty air blocks out the sun. Makes higher lighting bills.

Dirty air causes runs in nylon stockings and affects leather, glass, and paper products.

Student Activity

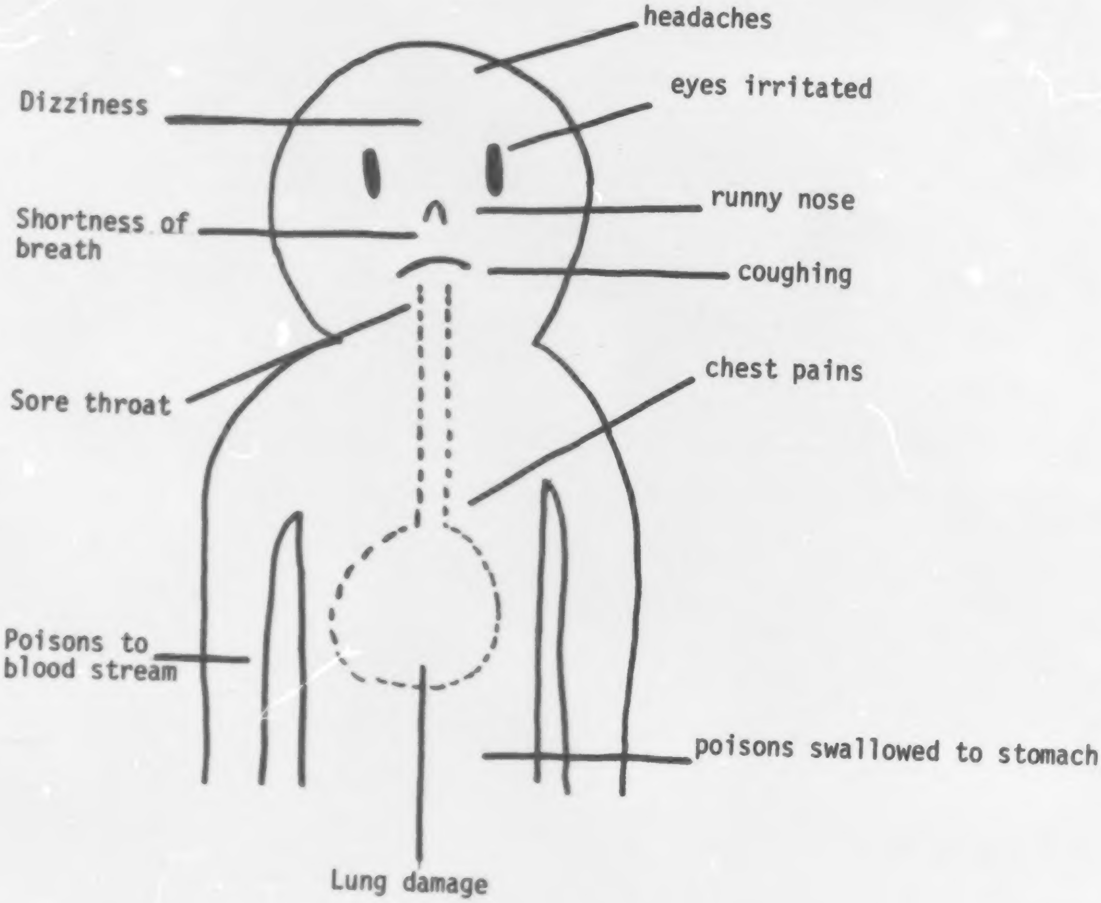

WARNING
Breathing may be harmful to your health!

Dirty Air Costs Lives

In every breath we take,

POLLUTED AIR

contributes to respiratory disease.


headaches
Dizziness
eyes irritated
runny nose
Shortness of breath
coughing
chest pains
Sore throat
Poisons to blood stream
poisons swallowed to stomach
Lung damage

3.1.2.2 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of how cities make their own weather so that at least 75% of the students studying urban air will correctly answer 7 of 8 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. A city has more dark and foggy days than the country around it because of
   a. tall buildings
   b. a lack of trees
   c. air pollution

2. Buildings and streets soak up heat. This makes a city
   a. cooler
   b. darker
   c. hotter

3. The hot air over cities rises, pushing rain clouds higher in the sky. As the rain clouds rise, they cool off. This causes cities to have _________ rain than the country around it.
   a. more
   b. less
   c. the same

4. A major cause of higher summer temperatures in the city is
   a. thunderstorms
   b. air conditioning
   c. outdoor cooking

5. An atmospheric condition known as inversion occurs when
   a. a layer of warm air seals in a layer of cold air beneath it
   b. a srong wind is blowing
   c. a thunderstorm develops

6. Thermal inversions frequently occur in Jacksonville because of
   a. strong southerly winds
   b. sea breezes
   c. cold fronts

3.1.2.2 Criterion Measure (continued)

7. The growing seasons in cities is longer than in the surrounding countryside because

   a. cities are cooler
   b. there are more indoor plants
   c. cities are warmer

8. A combination of smoke, fog and automobile exhausts is called

   a. soot
   b. smog
   c. sleet

To the Teacher

3.1.2.2

How Cities Make Their Own Weather

Air pollution can cut down on the amount of sunlight that reaches a city. And often drops of water collect around the bits of dirt floating in the air. As a result, a city has more dark and foggy days than the country around it. But this is only one way that a city changes its own weather.

If you listen to weather reports, you know the temperature in the city is usually different from the temperature in surburbs a few miles away. The buildings and the streets soak up heat from the sun and stay hot all night. Air conditioners pour hot air into the city streets. As a result, cities are hotter during the summer days and nights than the country around them. In the winter also, the streets and buildings soak up heat from the sun. And the buildings are heated inside. That keeps the city warmer than the country in the winter.

The warmth of the city also cuts down on the number of days northern cities have snow. And plants have three to four weeks longer to grow. In New York City, flowers may still bloom in window boxes at Thanksgiving time. A few miles away in New Jersey, frost may have killed the same kinds of flowers a month or more earlier.

A city also may have more rain that the country around it. The hot air over the city rises, pushing rain clouds higher into the sky. As the rain clouds rise, they cool off. And the more they cool off, the more water they drop.

Student Activity

3.1.2.2
SC

Weather Report

Air pollution comes from many places. In a city where many kinds of pollutants pour into a small amount of air, pollution sometimes gets very strong.

Pollution can get so strong in cities that it can eat away the stone of buildings and metal of statues. It can cause paint to peel and some kinds of cloth to dissolve. Only a few kinds of trees can grow along city streets because of pollution.

But by far the worst danger from air pollution is the danger to health. Air pollution can cause many kinds of lung diseases, perhaps even cancer. When pollution gets bad, it may kill people who are old or weakened by other diseases.

The weather can affect the amount of pollution in the air you breathe.*

Usually air near the ground warms up and rises. The rising warm air carries pollution up with it where the breezes spread it over a wide area.

It is helpful for the city to have the pollution carried away. But everywhere is somewhere and the pollution is spread to "somewhere". People that live in areas near Jacksonville may find many unwanted pollutants in their air also.

Weather conditions over a city can make pollution worse. Sometimes a layer of warm air forms high in the sky. This warm layer keeps the cooler air under it from rising.

The city continues to pour smoke, soot and fumes into the air. If the air cannot rise, the pollutants collect. Finally a huge layer of polluted air covers the city.

This condition is called a thermal inversion. It may hang there for many days until the layer of warm air moves away. A thermal inversion can be very dangerous to health. In an industrial area where there is a lot of pollution put into the air, it can cause serious illness and even death.

Watch the weather report on T.V. to see when there is a thermal inversion over Jacksonville.

* When air moves from one place to another, it carries away and scatters air pollution. Fresh, clean air is brought in. Jacksonville is near the ocean. The sea and land breezes move air across the city.

The amount of water in the air also can help to remove pollution. The rain or snow knocks the particles floating in the air to the ground.

Student Activity

3.1.2.2
SC

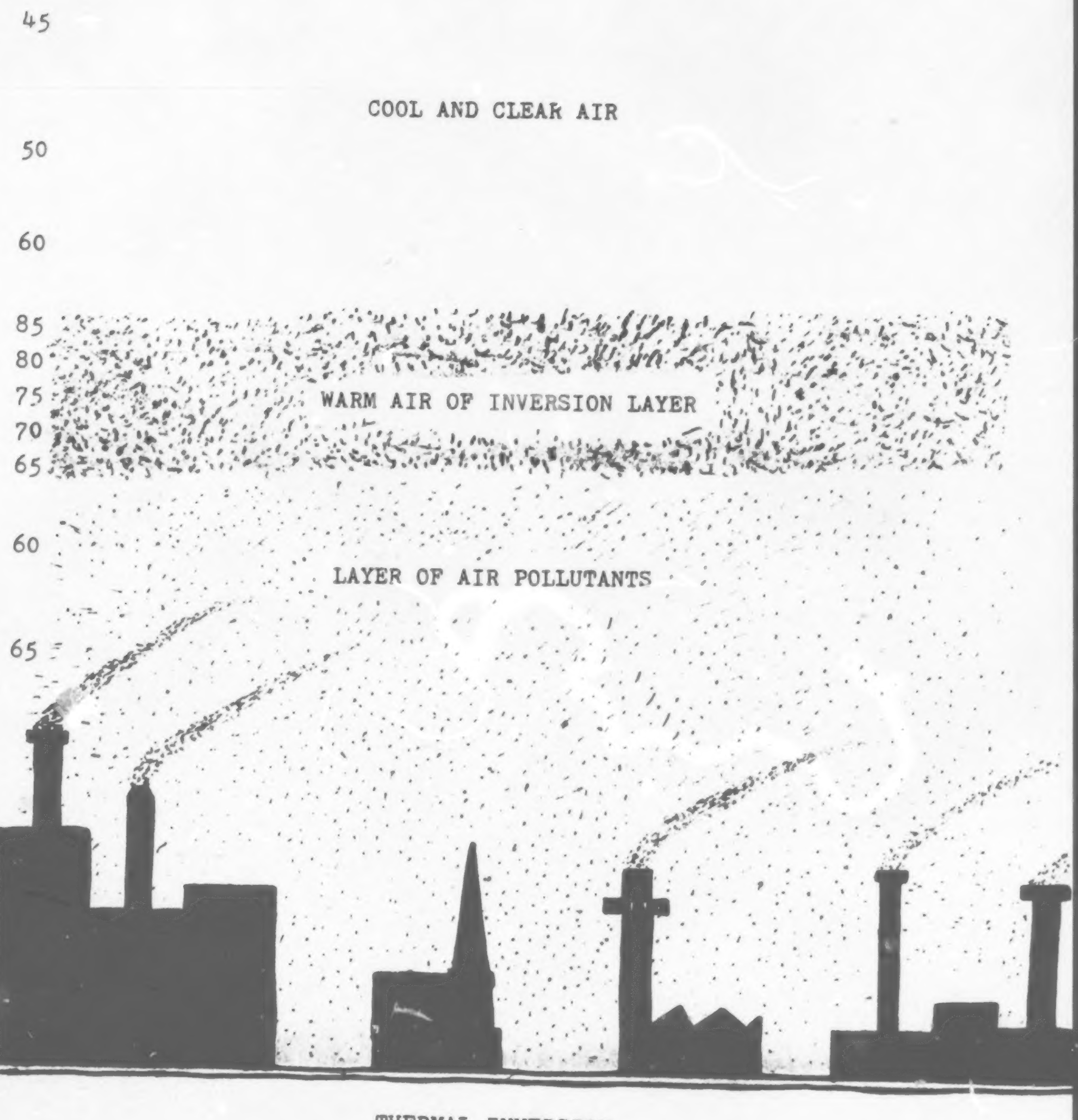
Air Pollution Checklist

Below is an air pollution checklist. Choose a clear day when the air above Jacksonville is moving and spreading the air pollution over a large area. Go outside and observe the pollution conditions. Record your observations under the heading Clear day conditions.

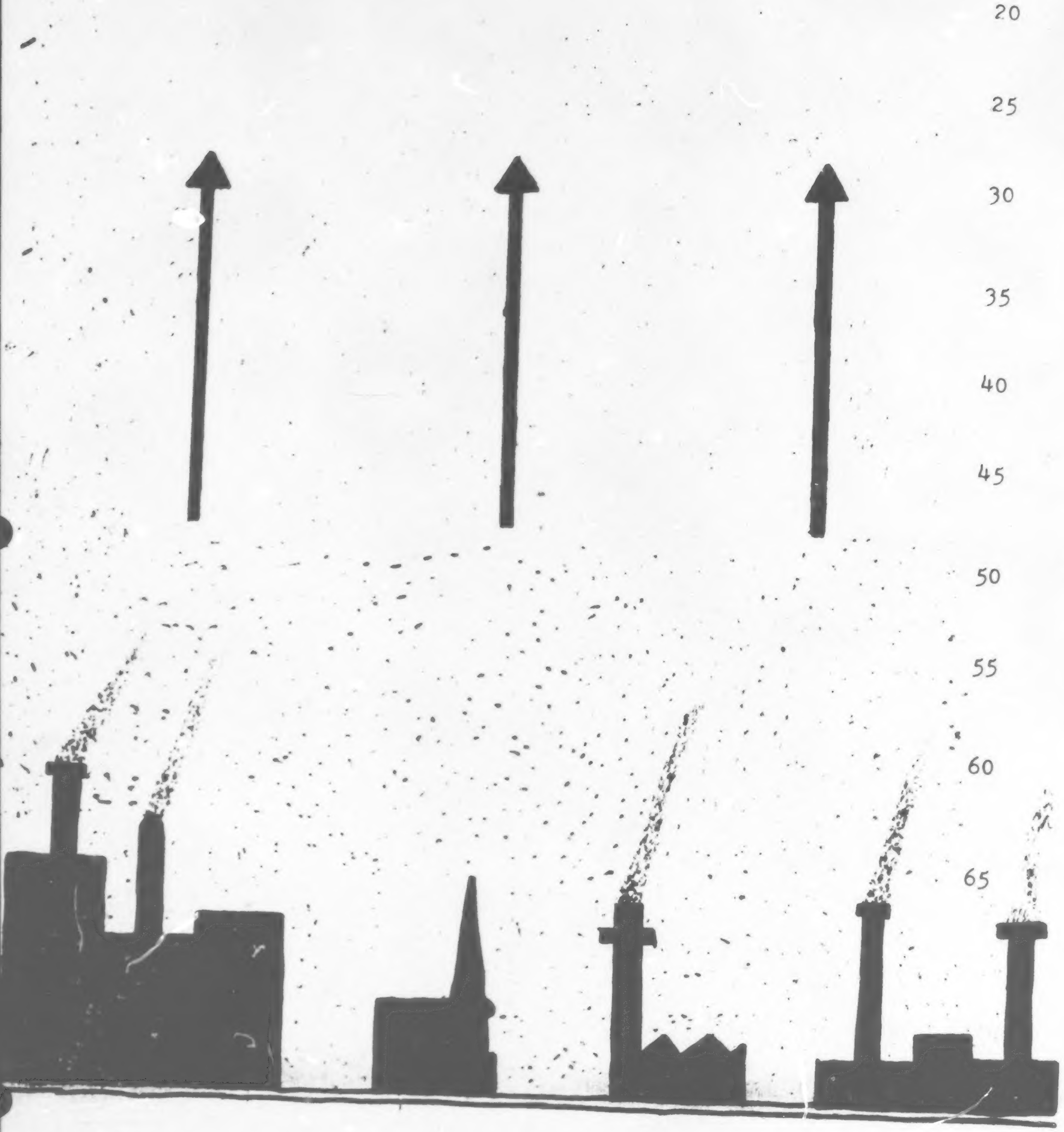
Now, listen to the T.V. weather report. When you hear there is a thermal inversion over Jacksonville, go outdoors and observe the pollution conditions. Record your observations under Inversion conditions.

	Clear day conditions	Inversion conditions
1. What is the fartherest building you can see?		
2. Is the visibility (how far you can see?) good-average-poor		
3. Check a light-colored, smooth surface. How many particles of pollution have settled? none-a few- many		
4. The air smell? no smell-o.k.-awful		
5. Is it hard to breathe?		
6. Does it burn your eyes?		
7. How does your nose feel?		
8. How does a day like this make you feel? happy-excited-lazy-o.k.-blah		

Compare the two columns. Does the inversion make pollution conditions worse or better?- Will there be a difference if the inversion hangs over Jacksonville for two or three days? What will the difference be?


45
COOL AND CLEAR AIR
50
60
85
80
75
WARM AIR OF INVERSION LAYER
70
65
60
LAYER OF AIR POLLUTANTS
65

THERMAL INVERSION


20
25
30
35
40
45
50
55
60
65

NORMAL ATMOSPHERIC CONDITIONS

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

THE CITY IS. . . .

Part I 3.1 Resources in an urban ecosystem

- 3.1.1 The ways land is used in the city
  - 3.1.1.1 The types of housing in the city
  - 3.1.1.2 The types of industries in Jacksonville
  - 3.1.1.3 The types of commerce in Jacksonville
  - 3.1.1.4 The types of transportation serving Jacksonville
  - 3.1.1.5 The uses by government of land in Jacksonville
- 3.1.2 How man affects urban air
  - 3.1.2.1 The kinds and sources of urban air pollutants
  - 3.1.2.2 How cities make their own weather
- 3.1.3 The importance of ground and surface water to the City of Jacksonville
  - 3.1.3.1 The supply, distribution, and use in the city of ground water
  - 3.1.3.2 Characteristics and function of surface water in the city
    - 3.1.3.2.1 The characteristics of the St. Johns River
    - 3.1.3.2.2 The functions of surface water in the city of Jacksonville
- 3.1.4 To recognize urban plants and animals, their habitats, food and adaptations
  - 3.1.4.1 To recognize urban plants, their habitats, and adaptations
    - 3.1.4.1.1 Some of the urban plants are cultivated by man
    - 3.1.4.1.2 Some urban plants are volunteers
  - 3.1.4.2 Urban animals, their habitats, food, and adaptations
- 3.1.5 The sources and kinds of energy used in Jacksonville

3.1.3 IPO Criterion Test

For the intermediate grade students of environmental studies to develop an awareness of the importance of ground and surface water to the City of Jacksonville so that 75% of the students studying city water will correctly answer 13 out of 15 multiple choice questions.

Circle the letter of the correct answer to each question.

1. The aquifer, as a source of water, depends on man's not taking out of the aquifer more water than
   a. can be easily stored
   b. flows in
   c. he puts in
2. Jacksonville has a good supply of water because Florida gets enough
   a. rainfall
   b. sunshine
   c. tourists
3. Hot water dumped into the river is called thermal pollution. Since even a few degrees rise in temperature reduces the amount of oxygen in the water, fish are in danger of
   a. freezing
   b. being caught
   c. suffocating
4. Pumping stations
   a. treat sewage
   b. send water to homes and businesses
   c. drill wells
5. Pollution is greater in the small tributaries than in the St. Johns River itself
   a. the water moves faster
   b. there is more water
   c. there is less water

3.1.3 Criterion Test (continued)

6. Ground water and surface water are both used

   a. in swimming pools
   b. by industry
   c. in homes

7. Linerboard and paper manufactored in Jacksonville are the ports largest

   a. imports
   b. tourist attraction
   c. export

8. A loss of dissolved oxygen in the water is caused by

   a. heavy pollution
   b. fish using it up
   c. heavy rainfall

9. Water enters the Florida Aquifer through

   a. the St. Johns River
   b. wells
   c. lakes and sink holes

10. A source of pollution to ground water and surface water is

   a. septic tanks
   b. salt water marshes
   c. rainfall

11. Some industries in Jacksonville use ground water to run

   a. typewriters
   b. steam turbines
   c. elevators

12. Because of the influence of the ocean upon the St. Johns River the river is called a

   a. large river
   b. a tributary
   c. a tidal river

3.1.3 Criterion Test (continued)

13. The flow of the St. Johns River to the ocean may be blocked when there is a very high tide and a stong wind from the ocean. When this happens there is a build-up in the river of

    a. oxygen
    b. pollutants
    c. fish

14. Industry is the greatest used of ground water. In many processes industry could help preserve our ground water by using

    a. recycled surface water
    b. water from wells
    c. oil

15. Jacksonville has grown as an industrial and commercial city because

    a. of nearby coal mines
    b. of the river
    c. it is in Florida

3.1.3.1 Criterion Test: Learning Step

For intermediate grade students of environmental studies to acquire knowledge of the supply, distribution and use in the city of ground water so that 75% of the students studying city water will correctly answer 8 out of 10 multiple choice questions.

Circle the letter of the correct answer to each question.

1. Jacksonville's supply of ground water comes from

    a. the Florida Aquifer
    b. the St. Johns River
    c. the ocean

2. Salt water intrusions occur when

    a. the moon is full
    b. the tides are high
    c. too much fresh water is removed from underground sources

3. A chemical added to ground water at the pulping station is

    a. iodine
    b. alcohol
    c. chlorine

4. A smelly gas called hydrogen sulfide is removed from our ground water by

    a. aeration
    b. chemicals
    c. hand

5. From the pumping station, water is distributed to homes by

    a. truck
    b. large underground pipes
    c. railroad

3.1.3.1 Criterion Test (con't.)

6. Industries use large amounts of ground water because

   a. it is impure
   b. it contains
   c. it is cheap

7. In Jacksonville the water used in homes comes from

   a. underground sources
   b. the river
   c. salt water marshes

8. Many industries get their water from

   a. lakes
   b. their own wells
   c. cisterns that collect rain water

9. In Jacksonville our present supply of ground water in the aquifer is

   a. polluted
   b. salty
   c. pure

10. We depend on rainwater to recharge the

   a. batteries
   b. aquifier
   c. swimming pools

PAGE 92 MISSING FROM DOCUMENT PRIOR TO BEING
SHIPPED TO EDRS FOR FILMING.
BEST COPY AVAILABLE.

The third aquifer lies beneath a thick layer of non-porous rock. In the Jacksonville area the top of this aquifer is between 300 and 600 feet below sea level. It is made of thick limestone and is called the Florida aquifer. This water is sterile and very hard. It also contains hydrogen sulfide which gives it its "rotten egg" odor. Hydrogen sulfide may be removed by aeration (holding water in a pool or spraying it up in the air.) Water from this aquifer contains the proper amount of flourides for good dental health.

Wells drilled into this aquifer are referred to as artesian wells as they are under natural pressure and are free flowing. The amount of water that can be obtained depends on the well diameter, size of pump, depth of well and artesian pressure.

Most of the recharge (replenish) area for this aqifer lies in an area 30 to 60 miles southwest of Jacksonville in western Putnam, Clay, eastern Alachua and Bradford Counties. Water enters the aquifer through many lakes and sinkholes and moves northeastward toward Jacksonville and the ocean. Underlying the Florida Aquifer is a layer of salt water which will rise and intrude into the fresh water as the artesian pressure is reduced. This has already happened in many heavily populated areas of the state and there is concern that it might happen in Jacksonville. We are now pumping out more water than flows in. The pressure which causes this water to flow out of a well without pumping is dropping. As population and industry continue to grow, and the demand for water increases, artesian pressure will continue to decline until the aquifer will become contaminated with salt water and surface pollution. Geologists are not able to predict when this will happen. When it does occur, the action is irreversible and a new water supply must be found.

Distribution of Ground Water

There are five municipal water supply systems in Duval County: Baldwin, Atlantic Beach, Neptune Beach, Jacksonville Beach and Jacksonville. The largest is the area owned and operated by the consolidated city of Jacksonville. This system is presently supplying the same areas it did before consolidation, plus the additional public systems it has aquired. The other four systems furnish water only to customers within their municipal limits. Each of these produces water from deep wells (500 ft. to 2,000 ft.) drilled into the Florida Aquifer.

At each well field the water, which is sterile, is pumped from the wells through an aeration system to remove hydrogen sulfide, then into ground storage reservoirs. From there it is chlorinated to eliminate any bacterial contamination it may have picked up in the aeration process before it enters the distribution lines.

During the 1950's and 60's, there was a rapid increase in residential development in the unincorporated areas of the county. Therefore, real estate developers were forced to build their own water system. There are also many small private systems which serve individuals, apartments, motels and industries. There was little control over the drilling of surface or rock wells, but permits were necessary for drilling a well 300 feet deep or over. Wells of this depth are artesian wells and draw water from the aquifer.

To the Teacher

3.1.3.1

*Filmstrip set, Man and the Cities, Series 1: City Problems and Alternatives
Film 4 should be used with this section.

Student Activity

3.1.3.1
SC,LA

Water, Water, Everywhere?

Water is important to all living things. Give three ways water is important to you.

1.
1.____

2.____

3.____

Where do you think the water we use comes from? Try to think of an answer.

2. ____________________ Now, let's read to find out if you are right.

All fresh water comes from rain. In Florida we get plenty of water from rain because the average rainfall each year is 53 inches (4 feet, 5 inches). Much of the rainfall in Florida sinks into the ground where it collects in underground pools.

3.Why do you think Florida has a large supply of underground water?

____

As the rain water passes into the ground it seeps through different layers of earth and stone. In Florida, we are lucky because the bedrock is made of limestone. Limestone has tiny holes in it and acts like a sponge to soak up and hold the water. This layer of water bearing rock is called the Florida Aquifer. Water from the aquifer is pure and safe to drink.

As the water passes through the limestone, some chemicals, like hydrogen sulfide , are dissolved in the water. Sometimes people call our water "sulphur water" because it has picked up hydrogen sulfide from the rock layers as it passed through. This "sulphur water" has a strong smell.

4. What does water pick up as it passes through the rock layers in Florida?

____

Student Activity

3.1.3.1
SC,LA

Water, Water, Everywhere (con't.)

Jacksonville has a good supply of underground water. Wells are driven into the ground until they reach a point where the water is collected.

5. How does Jacksonville get the underground water? ______________________

Check your answer to Question 2. Did you know the right answer? ___________

Soon you will take a field trip to a Water Pumping Station in Jacksonville where you can find out how we get water from underground to your house.

Here are some words you will need to know. Try to remember them as you read.

aerate	(said like air rate) to supply with air
capacity	a measure of how much a container holds
chlorine	a gas with a strong smell that is used to make water clean and pure
contaminate	to make unclean and unusable by unwanted material
computer	a machine that can solve problems rapidly using information that people put into the machine
decontaminate	to make clean and usable by getting rid of unwanted material
hydrogen sulphide	a gas that smells badly and is found in many waters
reservoir	a place where something is kept in storage

Now try to use the new words. Use each word only one time.

1. Water is stored in a __________________________.
2. To make water smell better, we need to remove __________________ gas.
3. To be sure water is clean and pure, we add ____________________ gas.
4. The ____________________ is a machine that can tell people at the pumping station there is trouble at one of the stations.

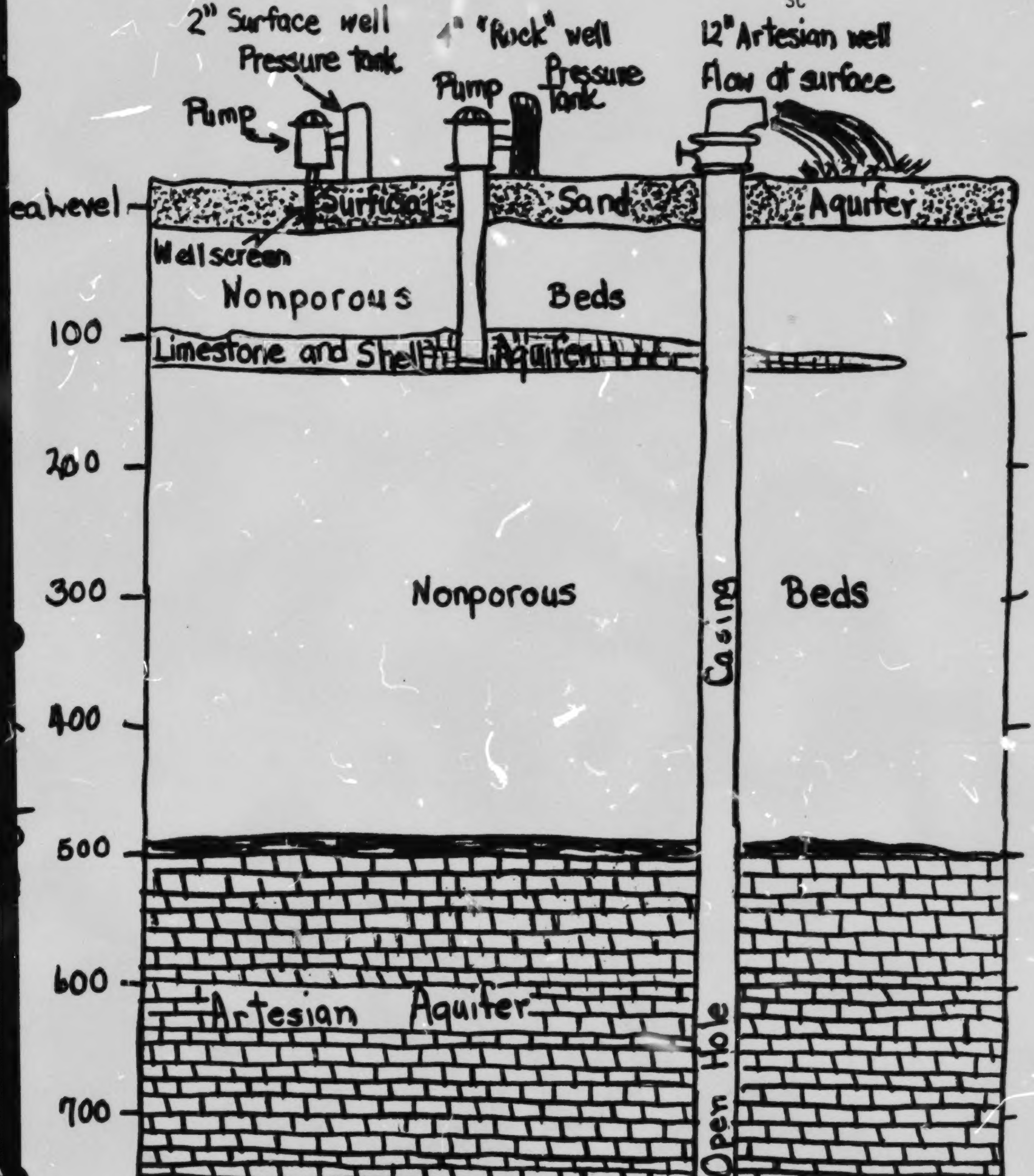
Water, Water, Everywhere (con't.)

5. When we pour water through air, we ____________________ the water.

6. The tanks hold one million gallons of water. The ________________ of the tank is one million gallons.

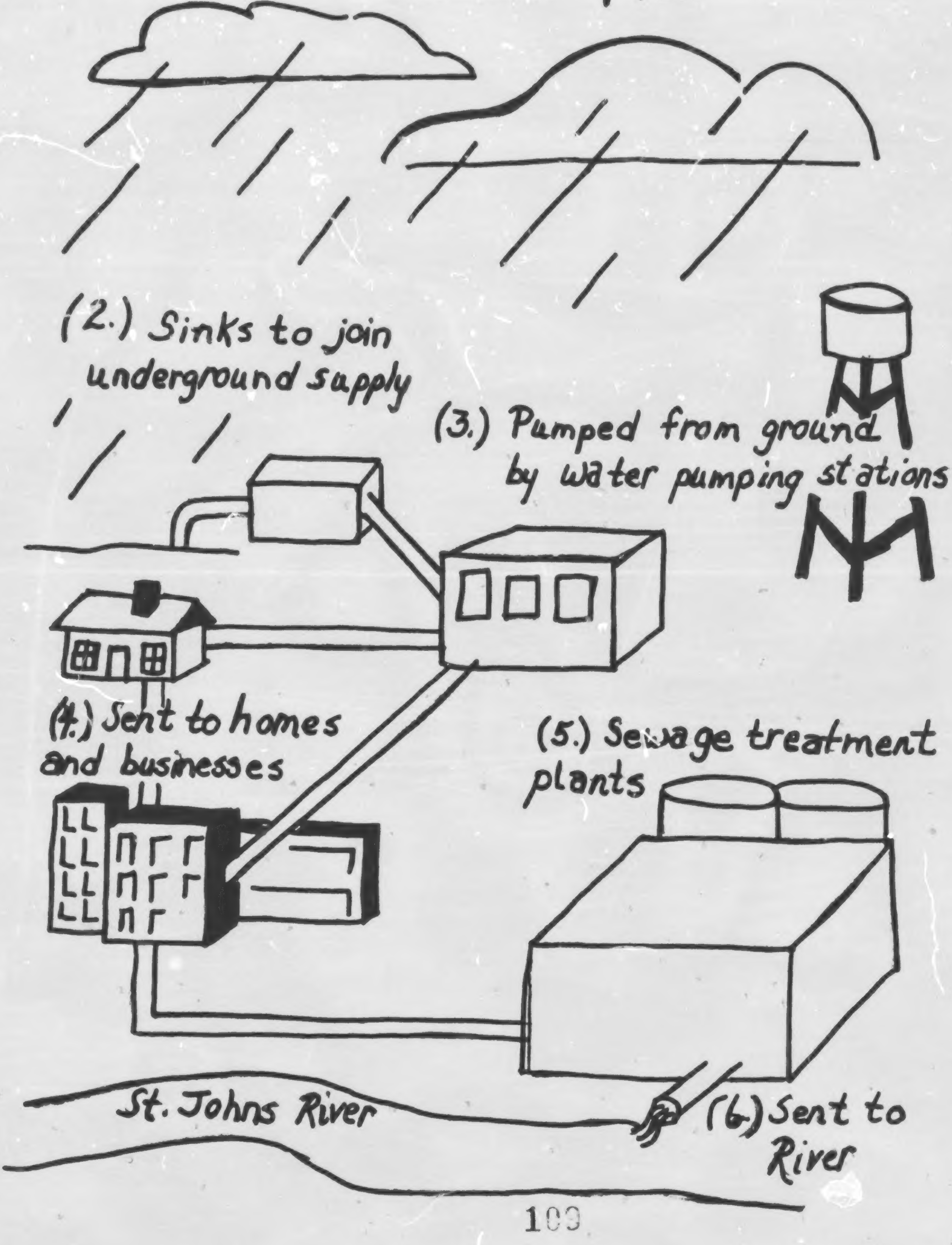
7. When we take the harmful materials out of water, we ________________ the water.

8. Harmful germs in the water ____________________ the water so that it is not safe to drink.


2" Surface well
Pressure tank
Pump
4" "Rock" well
Pump
Pressure tank
12" Artesian well
Flow at surface
ealevel
Surficial Sand Aquifer
Wellscreen
Nonporous Beds
100
Limestone and Shell Aquifer
200
300
Nonporous Beds
Casing
400
500
600
Artesian Aquifer
700
Open Hole

SC

Jacksonville's Water Flow


(1.) Rain
(2.) Sinks to join underground supply
(3.) Pumped from ground by water pumping stations
(4.) Sent to homes and businesses
(5.) Sewage treatment plants
St. Johns River
(6.) Sent to River

Student Activity

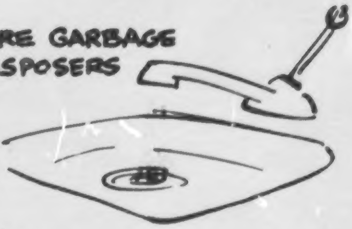
3.1.3.1
SC, SS

NOT ONLY **MORE** PEOPLE, **BUT**

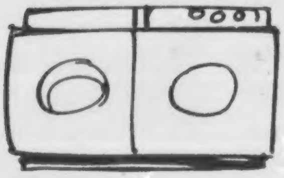
[illegible] PER PERSON

MORE BATH ROOMS

MORE GARBAGE DISPOSERS



HOME LAUNDRIES



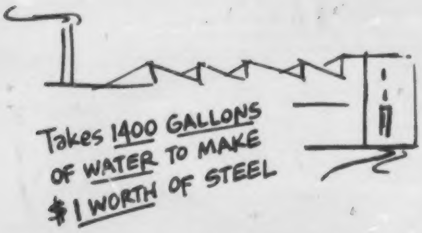
PER PERSON USE UP

[illegible]

SINCE 1900
(in U.S.)

LAWN SPRINKLERS

AND MORE USE IN



Takes 1400 GALLONS OF WATER TO MAKE $1 WORTH OF STEEL

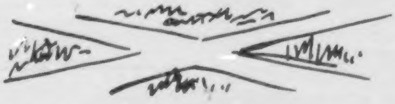
--industry use

UP since 1900

--uses **56 BILLION GALLONS PER DAY**
(in U.S.)

AND MORE USE IN

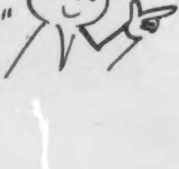
[illegible]



IRRIGATION use up

[illegible] since 1900

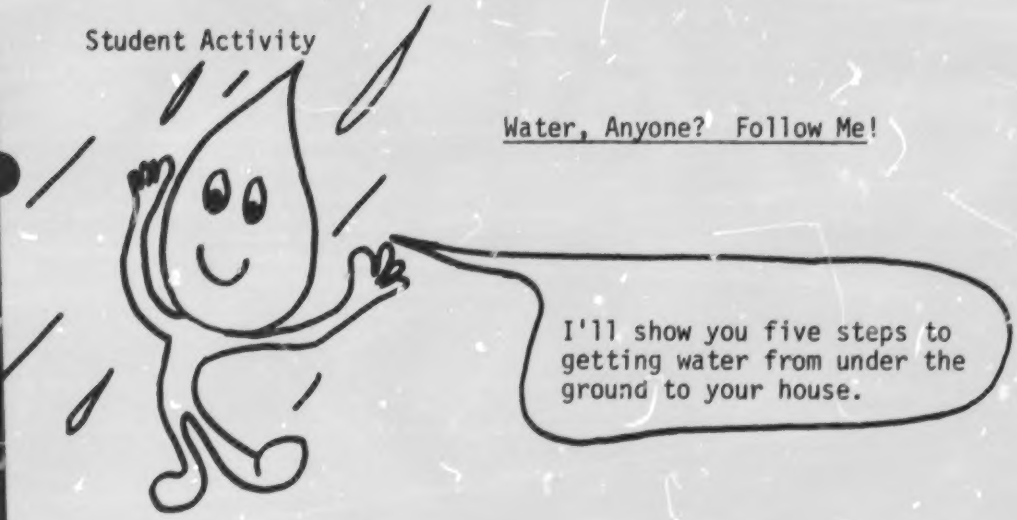
--uses **120 BILLION GALLONS PER DAY**
(in U.S.)



"There's just not enough clean water"

Total use of water--
TODAY--327 BILLION GALLONS
1980 (est.) **443 " "**
PER DAY

Water, Anyone? Follow Me!


I'll show you five steps to getting water from under the ground to your house.

Step one

The water is pumped up through pipes to the pumping station. Jacksonville has twelve pumping stations. Each pumping station has five to eight wells that pump water up from the underground supply.

Step two

The first place the water goes is to a reservoir. In the reservoir any solid particles (small pieces) settle at the bottom of the tanks. The pumping stations like to keep water in the reservoir for at least four hours. It is better to keep it longer whenever possible.

Step three

Sometimes you can smell a bad odor at a pumping station. This smell comes from a gas that was in the water. The gas makes the water smell and taste badly. It is called hydrogen sulfide. The hydrogen sulfide must be removed from the water.

To remove the hydrogen sulfide, you must aerate the water. This means to mix the water with air. The air bubbles releases the hydrogen sulfide.

Step four

Before water goes to your house, the city must be sure there are no bad germs in it that could make people sick. Chlorine is added to the water to kill any germs that may be in it.

Step five

Now water is pumped to all parts of the city; to houses, to factories, to hospitals, to schools.

Student Activity

3.1.3.1
SC

1. Would you get water at your house if the water pump stations all broke down?

 ____

2. Will we have water in the underground reservoir as long as we continue to have rain?

 ____

3. What will happen if we take out more water from the underground reservoir every year that the rain puts in every year?

 ____

You can see that our water supply is important. Without water, our city would die.

The five steps that water goes through at the water pumping station are written below. Put a number 1 by the first step, and a number 2 by the next step, etc.

______ Chlorine is added to kill germs

______ Water is pumped up from the underground collection area

______ Water is aerated to remove the hydrogen sulfide

______ Water goes to a reservoir where solid particles settle out at the bottom of the tank

______ Water is pumped out to all parts of the city.

Student Activity

3.1.3.1
Sc

Uses of Water

Involve the class in listing on the chalkboard the major uses of water in their community e.g. drinking, plant growth, cooling, recreation, manufacturing, street cleaning sewage removal, etc. Students should be asked to select one of the major uses and do some interviewing with knowledgeable people and some creative thinking to decide why water and not some other substance is used in their area of investigation. They should also be asked to report on what effect, if any, the use has on water quality in their community.

* Source: 100 Teaching Activities in Environmental Education

Student Activity

3.1.3.1
Sc, Ma

Amount of Water Used

Involve students in calculating the amount of water used daily in their a. homes, b. community, c. state, d. the United States--- a table such as follows might be useful. Selected individuals or small groups might investigate through interviews with key personnel the availability (present and future) of water in the community using survey questions such as those also suggested below. Finally discuss the findings with the entire class to determine what they might mean to individuals, industry, government or other groups.

Estimated Water Consumption

Source	Population	Use Factor (Gal/Person/Day)	Estimated Daily Water Use (gallons)
Home		150	
City		150	
State		150	
United States		150	
United States All Sources		1600	

Amount of Water Used con't.

Community Survey on Water Needs

1. What is the name of the person interviewed and what is his position?
2. Where does our city get its water? Is any rainwater collected?
3. Why do we get it from this source?
4. Have we ever had a water shortage? If so, when? Why did these shortages occur?
5. What action is or should be taken during a water shortage period?

   a. by the city:
   b. by industries:
   c. by Individuals:
6. Are there any other sources where the city could obtain water?
7. What plans have been made to meet the future water needs of the community?
8. Is the city recycling any water? Are there any plans to do this in the future? Why or why not?
9. Does the city supply water to any large industries? If so, how many millions of gallons per day go to each industry?
10. How much water is distributed daily to the residential areas of our community?
11. How is the water distributed in our homes?
12. What is the normal water pressure in the system? How is this pressure created? What size pipes are used?
13. Do we have reservoirs and water tanks? If so, where are they? How large are they?
14. Is our water treated prior to being put into the distribution system? If so, what is done to it and why? Can you draw us a diagram of this operation?
15. Does our city have an adequate water system? How could it be improved?
16. Are there any articles or reports which we can study in more detail?

Amount of Water Used (con't.)

Community Survey on Water Needs (con't.)

17. What is the present price-rate structure for city water? Do you have different rates for residential and industrial uses? If so, what is the difference and why is this the case?

* Source: 100 Teaching Activities in Enviromental Education

3.1.3.2 Criterion Test: Learning Step

For the intermediate grade students of environmental studies to acquire knowledge of characteristics and function of surface water in the city so that 75% of the students studying city water will correctly answer 8 out of 10 multiple choice questions.

Circle the letter of the correct answer to each question.

1. From downtown Jacksonville to the ocean the St. Johns River is

    a. narrow
    b. salty
    c. clean

2. From its source to its mouth the St. Johns River flows

    a. south
    b. east
    c. north

3. Industries depend directly upon the Port of Jacksonville for

    a. the movement of raw materials and goods
    b. electricity
    c. workers

4. The flow of the St. Johns River may be reversed by

    a. a high tide and strong winds from the ocean
    b. an eclipse
    c. a drop in the water level

5. A thin layer of oil on the surface of the water may kill fish because

    a. it cuts down on the amount of oxygen dissolved in the water
    b. it diffuses sunlight
    c. it keeps fish from swimming freely

6. Heavy pollution from human or animal waste usually produces a

    a. high level of oxygen
    b. thermal inversion
    c. high coliform bacteria count

7. Although oysters thrive in water containing bacterial pollution, these oysters are

   a. bad tasting
   b. dangerous to eat
   c. small

8. There are many state, city, and privately operated marine loading ramps for

   a. ocean liners
   b. pleasure boats
   c. barges

9. Disposal of spoil from dredging and construction projects may be a problem. A good use for this material is

   a. to add sand to the beaches
   b. to fill up salt marshes
   c. to build dams

10. Sewage treatment plants are required by law as a protection for

   a. ground water
   b. ships
   c. the river and the community

3.1.3.2.1 Criterion Test: Learning Step

For intermediate grade students of environmental studies to acquire knowledge of the characteristics of the St. Johns River so that 75% of the students studying city water will correctly answer 4 out of 5 multiple choice questions.

Circle the letter of the correct answer to each question.

1. In the Duval County, the St. Johns River is affected by

   a. tides and wind
   b. temperature inversion
   c. humidity

2. The St. Johns is salty from the ocean to

   a. Mayport Naval Station
   b. downtown Jacksonville
   c. its source

3. The difference in height above sea level between the river's source and mouth is about

   a. two feet
   b. 100 feet
   c. 20-25 feet

4. About 7 1/2 billion gallons of water a day reaches the river system from

   a. rainfall
   b. canals
   c. industries

5. A high tide and strong winds from the ocean can cause the St. Johns River to

   a. run dry
   b. reverse its flow
   c. flow into the Florida aquifer

To the teacher 3.1.3.2.1

The St. Johns River

One reason there is no pollution yardstick is that experts don't agree on what pollution is.

Generally, there is an idea.

Considering the delicate balance of life in the river and its dependency on the physical conditions around it, pollution is generally thought to be anything that changes that environment.

A lot of things can change the environment of the river life.

Chemicals can be poisonous. Sewage can add unhealthy bacteria. Industries sometimes pour hot water into streams, making the river unbearable for some life forms.

But then changes just as great can occur when a combination of winds and tides force salt water far upriver. A good rainstorm can drain a swamp of tons of decaying plant and animal organisms, providing feed for a bacteria population that will grow until it suffocates itself in the waters of small streams, sucking so much oxygen from the water that fish can no longer live there.

The man who heads the surveillance section for the Florida Department of Air and Water Pollution Control, Kay K. Huffstutler, looks around his Tallahassee office and puts the problem this way:

"If there are 10 guys up here and you ask them what pollution is, they'll give you 10 different answers."

One difficulty pollution experts encounter in deciding how a river has been damaged is deciding what was the river's natural state.

Comparisons can be made with similar untouched streams, but state pollution officals say the St. Johns is one of a kind.

"You can't really compare the St. Johns River with another river," says Huffstutler.

Pollution department chemist Jay Carver agreed:

"In the upper St. Johns, the biota (plant and animal life) are more akin to a lake than a stream."

And yet it is not a lake.

"Because of an extremely slight change in elevation along its length (20 to 25 feet in 300 miles), the flow is dominated by winds and tides," states a department report.

Generally, the river is 22 miles inland and parallels the sea coast. The drainage area comprises about 8,000 square miles. Tidal effects are felt regularly at Palatka and have been felt as far as Lake Harvey above Sanford. The tidal changes at Jacksonville average above 1.1 feet. The river level in the tidal portion is strongly influenced by the winds and, at times of long continual strong winds from the easterly quadrant, the level of the water surface at Jacksonville may rise between four and five feet above mean sea level.

So gentle is the river's meander northward from St. Lucie County to Mayport, a high tide and northeast wind can actually reverse its flow.

While the salt water-fresh water dividing place is generally considered to be its narrow turn by downtown Jacksonville, sea water has intruded- in traces- as far upstream as Lake St. George, 160 miles from the Atlantic Ocean.

The headwaters on the western edge of the St. Johns basin drop easily as runoff or spring flow from the Ocala limestone ridge that plunges through the center of Florida. But from the southern marshes, standing water flows as easily into one basis as another.

The non-river characteristics of the river have a lot to do with the effects of pollution. And they make it difficult to say just how polluted the river is.

An average of 53 inches of rainfall a year pours 26.5 billion gallons of water a day into the river basin, its swamps, lakes and tributaries. About 19 billion gallons of that evaporates, is used by plants or seeps into the aquifer underground. But Florida Department of Natural Resources figures show that about 7.5 billion gallons, on an average, reaches the basin's water bodies daily.

Other water flows into the streams from springs- some half-billion gallons a day from Silver Springs alone.

The U.S. Geological Survey estimates the flow of the St. Johns River at an average of 3,278 cubic feet per second, but that's an average. It ranges from up to 17,100 cubic feet per second flowing toward the Atlantic Ocean to 3,030 cubic feet per second flowing in the opposite direction, from the Atlantic into the river basin.

When conditions are right for maximum flow of all that water, the St . Johns becomes a powerfully large river. All that water can handle a lot of pollutants without noticeable damage.

When the river reverses itself, the lower end becomes a ribbon-like tidal basin, scouring away man's influence by the whipping in and out of sea and river.

But when the river slows, it becomes a closed pool that is not well equipped to cleanse itself.

Under certain conditions, net discharge of the estuary (river) to the ocean may halt for days, leading to the rapid buildup of waste concentrations in the basin. If a water pollution "incident" is to be arrested, these conditions must quickly be indentified and remedial action taken.

Although they don't have a simple measure, the people who study the St. Johns know its problems.

They describe the condition of the river in general terms, becoming more specific when talking about certain types of pollution and certain effects.

The river is polluted, but state officals indicate it's a lot better off than you might expect.

"The basic problem of the river is over-nutrification," says Carver.

(But a word of caution-when Carver and others talk about the St. Johns River, they probably aren't talking about the river North Floridians know.)

The nutrification problem, Carver explains, is the plague of the upper river, the stretch from St. Lucie, Okeechobee and Indian River counties to Lake Monroe at Sanford. This is where marshes and lakes abound and the river is ill-defined.

Huffstutler says the problem stems from three basic sources: Sewer systems, farms and nature. It comes in forms of sewage, fertilizer and decaying organic materials.

Plants feed on those nutrients, clogging the waterways. Left alone, the plants will take care of the excess nutrients.

But to solve the navigation problems of the shallow, weed-clogged waterways and to keep water off agricultural lands in the upper St. Johns, the Corp of Engineers is constructing an extensive canal-reservoir system.

The dredging and clearing irritates Huffstutler.

"They're trying to make a canal out of the whole river," he complains.

Carter said dredging and clearing the waterways eliminates the shallow areas so abundant with small plant and animal life.

As the little streams are cleared, Huffstutler warns, the plants that digest the nutrients are eliminated. The fertilized water then may affect the lower reaches of the river.

"The lower sections may become just like St. Lucie County where algae blooms occur several times a year," Huffstutler says.

"Mother nature has provided all that swampy area, he continues. "And when the swamps are drained, pollution gets the blame. You see, the physical environment has a relation to the chemical and biological environment."

Huffstutler says the best surveillance on the river is done in the south of Lake Monroe.

North of that point, the river changes character, becoming well defined through Lake George where it spreads into a huge lake and swamp.

In Orange and Seminole counties, the river gets a great deal of sewage with the accompanying nutrification and bacteria. The condition of the river north of there improves.

From Sanford to Palatka, Carver says, there is some weed problem. Bacteria dumping, from sewage at the Palatka municipal sewer system is the first major intrusion of that kind along this stretch.

The Lake George-to-Palatka area, convergence point of the Oklawaha and the section billed as "The Bass Capital of the World", Carver says "is still in fairly good condition."

At Palatka, the Hudson Pulp and Paper Co. feeds treated waste into the river from Rice Creek but from shortly north of there, all the way to Jacksonville- about- 50 miles- the river is practically untouched.

"This is our smallest problem area," says Carver.

In the Jacksonville urban area, the river collects sewage- some treated, some untreated. Industrial wastes and heated cooling water are pumped into it. Huge ships plow over it and oils and other sludge contaminate the surface.

But how extensive is the problem in Jacksonville?

"Where the term 'dead river' is used, it's being used bacteriologically," Carver explains, adding that the whole river at that point is certainly not dead.

Coliform bacteria checks show concentration of bacteria in the St. Johns increases as the river flows into the heart of Jacksonville, peaking at the Mathews Bridge. By the time it flows to Mayport, the coliform count is almost "background".

The presence of coliform bacteria indicates the probability of sewage, although the bacteria also comes from other sources. Paper mill wastes, for instance, usually have a high bacteria count, Carver says.

The presence of bacteria doesn't mean a health problem. But Carver says "an abnormally high coliform count would imply an unnatural source."

That source could present a health problem. The chances are high, he says, that pathogens (disease-causing organisms) may be included in an abnormally high concentration of coliform bacteria.

"We hope to come to a point where we will be equipped to measure fecal coliform bacteria," Carver says. That would involve measuring only the concentration of bacteria from human and animal waste. It would be a better indicator of the health hazard.

The bacteria count affects the population directly because of water regulations.

Swimming is forbidden if samples show a high concentration of coliform bacteria. Requirements for drinking water are even stricter.

The size of the river in Jacksonville prevents the sewage from developing into an over nutrification problem.

In Jacksonville, a few other pollution problems exist, says Carver, but besides bacteria, the only major problem is floating debris. The river carries with it a great amount of trash.

Wastes from paper mills and other industries are localized problems, Carver said.

St. Regis Paper Company has a large manufacturing plant located on Broward River, a short distance from the St. Johns. The company has been the object of complaints from pollution officals and nearby residents.

"You could trace the paper mill wastes for some distances," Carver says. "But you couldn't find it, say around the Acosta Bridge at high tide and hardly at Mayport at low tide."

Paper process wates are often blamed for causing a depletion of oxygen in the water, making it difficult for animal life to exist. But Carver says the lower St. Johns "is too big a body of water for oxygen demand problems."

3.1.3.2.2 Criterion Test: Learning Step

For intermediate grade students of environmental studies to acquire knowledge of the functions of surface water in the city of Jacksonville so that 75% of the students studying city water will correctly answer 8 out of 10 multiple choice questions.

Circle the letter of the correct answer to each question.

1. Industries in Jacksonville use the river to provide water used in industrial processes as well as

   a. for drinking water
   b. a place to dump indusrial wastes
   c. for fishing

2. The most serious problem resulting from heavy pollution of surface water is

   a. the bad odor
   b. trash in the water
   c. a loss of dissolved oxygen in the water

3. Cities dump their sewage into rivers and streams beacause

   a. it is the best place to put it
   b. it is easier and cheaper
   c. it doesn't hurt anything

4. The river is important to trade and commerce in Jacksonville because

   a. it makes Jacksonville a port city
   b. stores are built along the river
   c. people travel on the river

5. Automobiles manufactured in foreign countries are one of Jacksonville's largest

   a. industries
   b. exports
   c. imports

3.1.3.2.2 Criterion Measure (con't.)

6. Because of the river one major industry in Jacksonville is

   a. shipbuilding and repair
   b. salmon fishing
   c. coal mining

7. Heavy metals, acids, and caustic chemicals are forms of

   a. sewage disposal
   b. oil pollution
   c. industrial pollution

8. A high coliform count indicates heavy pollution from

   a. oil
   b. human or animal waste
   c. dead fish

9. Use of the St. Johns River in Jacksonville for recreational purposes is limited because of

   a. pollution
   b. the danger from sharks
   c. floods

10. In early days rivers were used by people as a source of travel. With today's methods of transportation the St. Johns River

    a. helps railroads
    b. has to be crossed by boat
    c. divides Jacksonville

To the Teacher

Water Pollution

Jacksonville (Duval County) is located in Northeastern Florida adjacent to the Atlantic Ocean. The area of 839 square miles includes approximately 15 miles of excellent beaches and 282 square miles of marshes, tidal estuaries and swamps. The northerly flowing St. John's River bisects the county and is tidally influenced throughout the entire area. The land is flat, rising from sea level to a maximum elevation Of 95 feet in the southwestern sector. Surface drainage is poor because of the flat terrain and creeks and streams are very slow moving. The ground water table is very shallow, rising to near the surface in over one third of the area.

The presence of the St. John's River and its entrance to the Atlantic Ocean has been instrumental in the rapid nature of Jacksonville's growth. The population of Jacksonville, which is presently 572,500 has been growing at an annual rate of about 2% per year. The subtropical climate has attracted a wide variety of people from all over the world.

The marine nature of the environment, the large slow-moving rivers, the tidal influence and the flat terrain have fostered very highly complex aqueous ecosystems. These have been seriously disturbed and altered by the encroachments of man. The signs of these disturbing influences of man are visibly apparent in increasing number of fish

Water Pollution (con't.)

kills, complaints of odors, dirty water, dirty boats, bad tasting water, foul shellfish and algae blooms. There are other less obvious signs, such as: increasing bacterial counts, invisible toxic substances, acids, heavy metals and low dissolved oxygen readings.

Water Quality Problems

What has been the result of the extremely heavy pollution load on Jacksonville's water quality? We must consider the answer to the question in several forms because water quality is measured in various ways.

The foremost measure is in terms of the dissolved oxygen the water contains. The majority of Duval County waters are Class III, or recreational waters. Water Quality for Class III waters call for 5 milligrams per liter (mg/1) of oxygen or better. The extremely heavy Biochemical Oxygen Demand (BOD) on streams and rivers from pollution source effluents has reduced the average annual dissolved oxygen concentration of most streams to less than water quality standards. The St. Johns River, having a tremendous assimilative capacity, is above 5 mg/1 but has on occasion dropped below standards near the Main Street Bridge during summer months. In terms of dissolved oxygen, nearly all of the tributary streams in Duval County are polluted and are unable to support aquatic life. The two areas remaining above standards are Julington Creek and the Nassau River and its tributaries.

A second important measure of water quality is the concentration of coliform bacteria present. Class III water quality standards call for no grater than an average of 1,000 total coliform per 100 milliliter. A coliform survey of the St. Johns River and its primary tributaries in 1972-73 indicated that all river waters north of the Naval Air Station have coliform counts above Class III recreational water quality standards. These high coliform counts are a result of the large volume of untreated sewage entering the river from 75 raw outfalls.

Another form of water pollution is turbidity and heavy sedimentation from dredge and fill and construction projects. This form is usually temporary in nature and is limited by ensuring that proper pollution control measures are taken during construction.

Heavy metals, acids, caustic chemicals, grease and oils and many other substances, organic and inorganic, may be pollutants if found in quantities above state standards. These forms of pollution enter streams and rivers from industrial process waste waters. Stream monitoring and plant effluent sampling ensure that these forms do not degrade water quality.

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

THE CITY IS. . . .

Part I 3.1 Resources in an urban ecosystem

- 3.1.1 The ways land is used in the city
    - 3.1.1.1 The types of housing in the city
    - 3.1.1.2 The types of industries in Jacksonville
    - 3.1.1.3 The types of commerce in Jacksonville
    - 3.1.1.4 The types of transportation serving Jacksonville
    - 3.1.1.5 The uses by government of land in Jacksonville
- 3.1.2 How man affects urban air
    - 3.1.2.1 The kinds and sources of urban air pollutants
    - 3.1.2.2 How cities make their own weather
- 3.1.3 The importance of ground and surface water to the City of Jacksonville
    - 3.1.3.1 The supply, distribution, and use in the city of ground water
    - 3.1.3.2 Characteristics and function of surface water in the city
        - 3.1.3.2.1 The characteristics of the St. Johns River
        - 3.1.3.2.2 The functions of surface water in the city of Jacksonville
- 3.1.4 To recognize urban plants and animals, their habitats, food and adaptations
    - 3.1.4.1 To recognize urban plants, their habitats, and adaptations
        - 3.1.4.1.1 Some of the urban plants are cultivated by man
        - 3.1.4.1.2 Some urban plants are volunteers
    - 3.1.4.2 Urban animals, their habitats, food, and adaptations
- 3.1.5 The sources and kinds of energy used in Jacksonville

3.1.4 IRO Criterion Test

For intermediate grade students of environmental studies to develop an ability to recognize urban plants and animals, their habitats, food, and adaptations so that at least 75% of the students studying urban plants and animals will correctly answer 18 of 20 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Rats are usually found in large cities because
   a. water is plentiful
   b. they are attracted by man's waste
   c. they live in colonies

2. One reason why pigeons have adapted to city living is
   a. they are afraid of wild animals
   b. they eat only food scraps
   c. they are not afraid of people as many other birds

3. Squirrels are not usually found in cleared vacant lots because
   a. there is little water
   b. they like shade
   c. there are no trees

4. Ants are important city dwellers because they
   a. eat garbage
   b. kill spiders
   c. usually make their homes in old buildings

5. One reason trees are planted in cities is
   a. they provide shade
   b. they provide lumber for buildings
   c. they provide homes for wild animals

3.1.4 IPO Criterion Test (cont.)

6. Weeds thrive in the city because

   a. people like them
   b. they are tough, sturdy plants
   c. they are cared for by man

7. A bird commonly found in the city is

   a. a sparrow
   b. a quail
   c. a hawk

8. A vine often seen growing on city buildings is

   a. sweet pea
   b. ivy
   c. honeysuckle

9. Animals that depend upon man for food, shelter, and protection are

   a. wild animals
   b. scavengers
   c. domesticated animals

10. Food sources for birds found in a city lot are

   a. flowers
   b. rats
   c. worms, slugs, and insects

11. A fox would not survive very long on its own in a city because of

   a. lack of food sources
   b. air pollution
   c. zoos capture foxes

12. A city agency set up to enforce city animal laws is

   a. Orkin
   b. Sanitation Department
   c. Animal Control Agency

13. Diseases are often spread through crowded city areas by

   a. rats and roaches
   b. air pollution
   c. hospitals

3.1.4 IPO Criterion Test (cont.)

14. Bulldozers used to clear city land areas often

    a. collect trash
    b. remove top soil
    c. pollute the soil

15. Many people who live in apartments and have no yards have

    a. air fresheners in their homes
    b. house plants
    c. sprinkling systems

16. Food producing animals often kept in the city are

    a. tropical fish
    b. hamsters
    c. chickens

17. Cities plant grass along highways and expressways to

    a. control erosion
    b. provide oxygen
    c. keep cars off the shoulders of the road

18. A plant which causes a great deal of trouble to the city by clogging rivers and streams is

    a. water hyacinth
    b. day lily
    c. seaweed

19. A common city animal who burrows under lawns is a

    a. squirrel
    b. rat
    c. mole

20. Planes taking off and landing may face a danger from

    a. swarms of mosquitos
    b. flocks of starlings
    c. schools of fish

To the Teacher 3.1.4

Teacher content information for this section on urban plants and animals is found in the student activity- readings.

Student Activity

3.1.4
LA, SS, SC

Exploring All Year Long

Exploring in a vacant lot is an all-year-round activity. There is much to see in spring, summer, fall, even in winter. Here's a roundup of things to do during each season.

In the Spring

Look at the buds on trees and bushes. Many will be swelling or opening. See how the leaves are folded into the bud. On which kinds of trees do the leaves come out earliest? Does the weather have anything to do with the time the trees leaf? What happens to leaves on a cold spring day?

Look for dandelions and other early season flowers. See if bees and other insects are attracted to them. Watch how the insect burrows into the flower. It is getting the sweet nectar to eat. But in going after the nectar the insect also picks up some pollen. When it travels to another flower, some of the pollen drops off. In this way the ovules of a plant are fertilized by the pollen of another plant. When ovules are fertilized, a fruit develops around them. Without insect pollination many kinds of fruit, such as apples and cherries, would not develop.

Look at bare patches of soil in the lot. See if any new seedlings are beginning to show. Bare patches of soil are soon used by one kind of plant or another. By late spring there will be few bare spots left.

Birds are migrating northward now. Look for unfamiliar kinds in the trees and bushes. Perhaps you may see some stop off to hunt for insects or other food. Remember to note some things about them so that you can identify them later in a field guide.

Squirrels look shabby in the spring. They are losing parts of their thick winter fur. During very cold and severe winters squirrels may go into a long winter sleep called hibernation. But during more mild winters squirrels are up and about often. If the winter has been svere, look to see if the squirrels seem thin.

Summertime is insect time. Look and listen for insects in the lot. Perhaps you will hear a cricket in the early evening. Crickets chirp faster when the temperature is higher. In fact there is a formula for finding the temperature by counting the number of cricket chirps in fifteen seconds and adding forty. Try out the formula on both warm and cool nights to see if it works .

Examine some of the plants growing in the lot. Can you tell which of the plants belongs to the family of grass? The grass family is a very large one. It includes such tall grasses as bamboo, sugarcane, corn, wheat, and rice, as well as the more familiar lawn grasses.

Student Activity (cont.)

Here's how to recognize a member of the grass family. All grasses have a stem with solid joints. At each joint a leaf grows in an opposite direction from the one above and the one below. The leaf is longer than it is wide, and part of it is always wrapped around the stem.

Watch for sparrows and other birds bathing themselves in puddles of water after a rain. During dry periods dust themselves with dry loose soil. They flutter in the dust just as they do in the water. This probably helps them get rid of insect pests in their feathers.

On a hot day feel the temperature of the sidewalk and compare it to the temperature of a grass-covered spot in the lot. Which is hotter? Plants absorb some of the sun's rays and keeps the ground cooler than the unprotected sidewalk. Can you tell why the city in summer is usually hotter than the country?

Look for little mounds of earth on top of the soil. These are earthworm cats. Earthworms tunnel through the soil eating plant material. The casts are the remains of an earthworm's meal. Earthworms help to mix the soil and make it better for plants.

In the Fall

Make a collection of autumn leaves. The leaves of each kind of tree turn a certain color. See if you can identify the color of oak leaves and maple leaves. Warm days and cool nights are needed for a good leaf display in the fall. Note which trees lose their leaves earliest, which latest.

Look at the leaf scar left on a twig. Before a leaf falls, a layer of corklike material forms beneath the stem. This allows the leaf to fall off and at the same time seals the place from which the leaf grew. Trees that lose their leaves in the fall are called deciduous.

Those that keep their leaves in winter are called evergreens. The evergreens that bear cones, such as pine, spruce, and fir trees, are used for Christmas trees.

Look for insect eggs and cocoons on bushes and beneath rocks and logs. Eggs are all different shapes. It is difficult to tell what kind of an insect will hatch from the eggs that you find. Some of them may be from a spider, slug, or other small animal.

Collect seeds of different kinds of bushes, grasses, and trees. Many of the seeds will be packed together in some way. Open one of these seed packages and count the number of seeds within. Do you think that most of these seeds will grow into plants? Could all the seeds on all the plants grow into new plants? Why Not? Can you tell how the seeds are spread: by animals, wind or just dropping?

Look at the buds on trees and bushes. How are they protected against the winter? Open one of the buds and note the leaves or the flowers folded within. Most buds must go through a long period of cold weather before they will burst into bloom. This prevents them from mistakenly

Student Activity (con't.)

3.1.4
LA,SC,SS

blooming during a short spell of warm fall weather and then dying when winter comes.

Animals get ready for the coming winter in different ways. Look for squirrels gathering and storing acorns and other foods. Look for birds migrating south. You'll often see flocks of migrating birds overhead during the autumn.

In the Winter

Look for birds during the winter. What kind of food do they eat? Many of them depend upon people feeding them. Watch how their feathers fluff out on cold days. The feathers are full of tiny air pockets that act as insulators so that the birds will stay warm. Also look for abandoned bird nests at this time of year. The branches of trees are bare, and you can see the nests more easily. Don't remove the nests because they may be used by the birds next spring.

STUDENT ACTIVITY

If the Bulldozer Comes

A lot in a city may not remain vacant for long. One day men and machines may come and start to construct a building. Here is a chance for you to observe some new things about the lot.

Builders often use a power shovel to dig deep cuts in the soil. See if you can pick out the darker-colored layer of topsoil from the lighter-colored layer of subsoil. What is in the subsoil: rocks, clay, sand, gravel, or a mixture of these? Is the topsoil heaped in a mound for later use? Topsoil is good for lawn areas or other plantings. What happens to the soil when the plant covering has been stripped away and it rains?

Perhaps there is very little soil before the builder strikes bedrock. Bedrock is part of the earth's crust. It extends down for many miles into the earth. In some places, bedrock is covered by many feet of soil. In other places, bedrock lies just a few feet below the soil or may even be at the surface.

Has the builder uprooted any trees in the lot? Look at the size of the tree's root system. Now you can see why a tree is so difficult to turn over. Roots not only hold a tree firmly in the soil but supply the tree with the water and dissolved minerals it need.

What happens to the animal and plant life in the lot during construction? Some animals just move to a new location. Others may not be able to move and die. Do any plants remain or will the builder put in new plants afterward?

Man changes nature in many ways. You can look at and think about some

Student Activity (cont.)

of these changes in your no-longer-vacant lot. Then, perhaps, you can find another vacant lot to explore.

STUDENT ACTIVITY

Life in a Vacant Lot

After securing permission for a class to study a vacant lot, divide the class into teams of 3-5 and involve the teams in carefully staking out 12 feet square plots which they will study.

Each team can inventory the litter found in its plot and try to determine what effect this litter is having on plant and animal life. They may find, for example, that certain types of litter encourage or discourage growth of plants or animals.

Each team can examine its plot for signs of animal life such as burrows, tracks, or droppings. What kinds of animals live there? Why? Is any evidence found that indicates some animals are preying on some others?

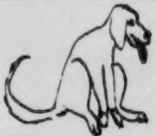
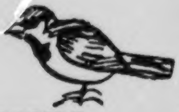
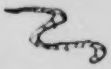
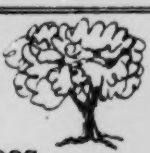
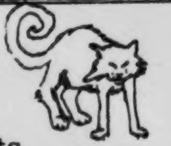
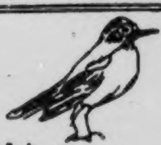
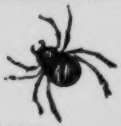
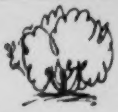
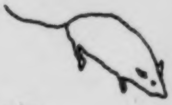
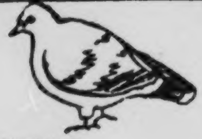
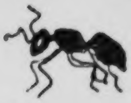
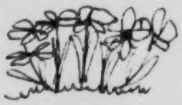
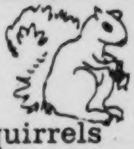
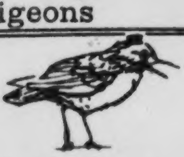
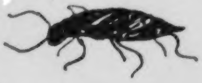
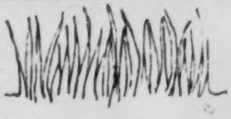
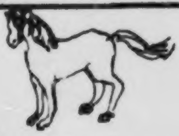
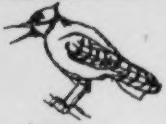
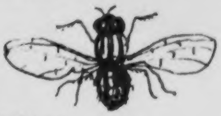
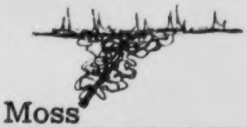
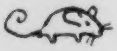
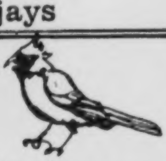
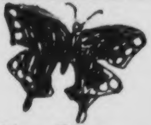
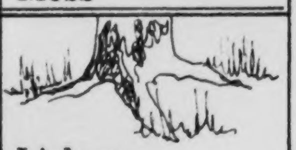
Each team can inventory the kinds of plant life found in its plot. Samples can be brought into the classroom and the children can develop their own plant key to be used by all teams in locating in their plot and subsequently on a large map of the vacant lot the most prominent types of plant life. The class may choose to discuss questions such as why certain plants are found where they are. What accounts for differences found in the same plant type? Are certain animals generally found around certain plants? Why?

Source: 100 Teaching Activities in Environmental Education

Student Activity

OTHER LIVING THINGS

Here are some other living things that make their homes in a city environment.

ANIMALS			PLANTS
Mammals	**Birds**	**Insects and other tiny animals**	
 **Dogs**	 **Sparrows**	 **Earthworms**	 **Trees**
 **Cats**	 **Robins**	 **Spiders**	 **Bushes**
 **Rats**	 **Pigeons**	 **Ants**	 **Flowers**
 **Squirrels**	 **Starlings**	 **Roaches**	 **Grass**
 **Horses**	 **Bluejays**	 **Flies**	 **Moss**
 **Mice**	 **Cardinals**	 **Butterflies**	 **Lichen**

Put a circle around the ones you have seen. If you can think of any that are not on the list, add them. Some of your circles will be around animals cared for by humans. You are going to learn more about the wild ones, those that take care of themselves.

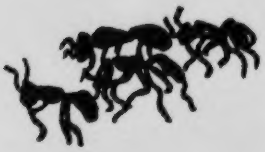
Source: A Place to Live

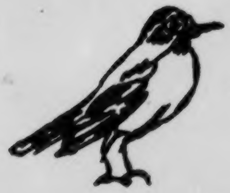
3.1.4
SC

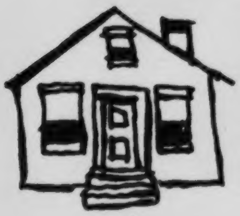
Student Activity

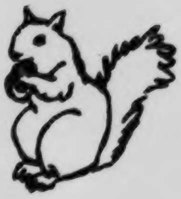
TRY THIS!

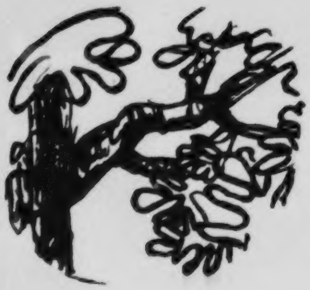
Draw a line between each animal and the habitat in which he lives.

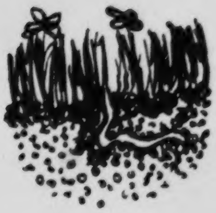


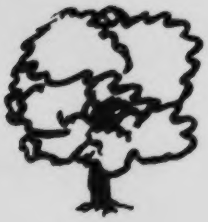


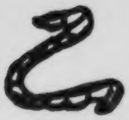


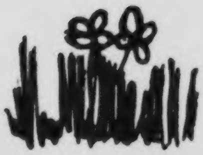


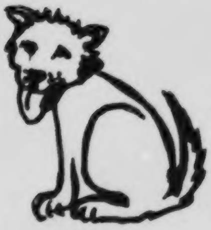












STUDENT ACTIVITY

Trees

Many trees grow wild on vacant lots. Look at the place where the tree is growing. Trees grow toward the light. If a tall building is set on one side of a tree, the branches on the other side may be much larger.

Trees that grow in a city have to overcome smoke, dust, and all sorts of other unfavorable conditions. Examine the bark of the tree. Has it been injured by people cutting it? Do you see scars where branches may have been cut off? Have animals such as dogs and cats injured the bark? Bark protects the tree. It grows over cuts and covers them. If the bark is stripped from a tree, it will die.

You may see where a branch has been cut from a tree and a ring of bark has grown back around it. Look for broken branches on the tree. These are often spots where insects and diseases enter the wood of the tree and cause it to rot. Sometimes the rotten wood of a tree is carved away by man, and a special cement is put in the hole. This helps to protect the tree from further rotting.

The leaves of a tree will tell you much about its condition. Drooping or curling leaves may mean that the tree is not getting enough water. The tree may not get enough water even when it rains. The water must go into the ground and reach the tree's roots. If the soil around the tree is hard and tightly packed, the water just runs off without going into the ground. You can help such a tree get enough water by breaking up the top two inches of the soil.

A tree may have as large a root system under the soil as it has branches above the ground. The large root system is needed because a tree takes in so much water. Even a small tree needs many gallons of water each week. When the tree is getting enough water and the minerals it needs, its leaves are green and healthy looking.

Look for large and small animals that use the tree and depend upon it. By late summer you will rarely find a single leaf on the trees that doesn't have an insect hole in it. You may find insects eating at leaves or in the cracks in the bark of the tree. Look also for spider webs strung from the branches of the tree. Can you tell how spiders help the tree?

Larger animals may also be found in the tree. Squirrels often leap from branch to branch in larger trees. Perhaps you will see them gathering acorns or other seeds. In the winter you may see a clump of dried leaves high in the branches of the tree. This is probably a squirrel nest.

You'll often see birds using a tree. They may be sitting on a branch preening their feathers with their bills or searching the tree for insects or seeds to eat. You may even see a bird building a nest. Be sure you don't disturb the nest, for any eggs or young birds in it may die.

A tree makes difference weather conditions for the living things around it. Stand uder a tree on a hot day. It is much cooler there and not nearly as bright as in an unprotected spot. Trees break the force of the wind and the falling rain. They bind the soil withtheir roots and keep it from being washed away. Trees provide shelter and food for many different animals.

3.1.4.1 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop an ability to recognize urban plants, their habitats, and adaptation, so that at least 75% of the students studying urban plants will correctly answer 8 out of 10 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. Trees growing near buildings are often one-sided because of

    a. lack of full sunlight
    b. large root systems
    c. nesting birds

2. Grasses grown in sidewlk cracks becuase

    a. the city plants it there
    b. they beautify the street
    c. soil is found there

3. Toadstools may grow in a vacant lot because

    a. rotted material is found there
    b. people like to eat them
    c. they need direct sunlight

4. Lawn and gardens are fertilized to

    a. limit plant growth
    b. provide additional plant food
    c. give plants vitamins

5. Some city plants are protected from being touched because

    a. they are wild
    b. they are poisonous
    c. they have blossoms

6. Trees and flowers are planted in cities by man to

    a. take up space
    b. repel insects
    c. make the area more attractive

3.1.4.1 Criterion Test (cont.)

7. A plant which is usually found in a vacant city lot is

   a. a petunia
   . a rose bush
   c. a dandelion

8. Plants found in a city park are usually

   a. planted by man
   b. growing wild
   c. smaller than plants growing in a

9. In a city, smoke, dust and fumes

   a. make the soil richer
   b. may harm plants
   c. fertilize plants

10. Shade trees growing in the city

   a. help keep summer temperatures down
   b. help raise summer temperatures
   c. reflect the sun's rays

STUDENT ACTIVITY

Weeds, Seeds, and Flowers

Weeds are plants that people often don't like to see growing. Weeds may grow in places where only certain other plants are wanted. Farmers, for example, try to get rid of weeds growing among their crops. Weeds are harmful to man in a few cases. Poison ivy, which irritates the skin, and ragweed, which is bad for hay-fever sufferers, are examples of harmful plants.

Vacant lots are usually full of different kinds of plants. Almost every bit of soil has something growing in it. Most people call these plants weeds. But to a scientist these plants are interesting to study and find out about. One person's weed is another person's plant.

Many weeds are tough, hardy plants. They grow just about anywhere. You'll find weeds growing in the cracks of sidewalks, in small pockets of soil atop rocks, and almost anywhere they can get through to the ground.

Some weeds are very pretty too. Gardeners call the dandelion a pest because new ones keep coming up where they're not wanted. But in a vacant lot, where no one cares which plants grow, you can appreciate their beauty.

You can recognize a dandelion by its yellow flowers set in a circlet of toothed leaves. Look for it in the spring. Pick a dandelion flower and you'll find that it is set on a hollow stalk. The stems and leaves hold a milky juice called latex. Milkweed is another plant that contains latex. Try uprooting a dandelion. The root is long and difficult to pull up. Now you know one reason why dandelions are so hard to get rid of.

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Student Activity (cont.)

When a dandelion has a white mane, its seeds are mature. Blow on one and watch the seeds as they are carried off by the wind. It might be fun to try to count the number of seeds on a single dandelion. Each seed could become a new dandelion if it lands in a place where it can grow. It's not difficult to see why dandelions are so common.

Other kinds of plants that may grow in a vacant lot are great ragweed, common ragweed, common yarrow, plantain, buckhorn, chickweed, quackgrass, lamb's-quarters, and crabgrass. All of these are flowering plants, but on some the flowers are tiny and hard to see. For example, in the spring, chickweed has many little white flowers about one-sixteenth of an inch across. If you look carefully, you'll see that even short grasses have tiny flowers.

Almost every patch of soil has some seeds in it. Collect some soil in a clean can or a milk container with its top removed. Take the soil home and sprinkle some water on it. Keep the soil moist but not muddy. After a few days or a week you'll probably find some seedlings growing in the soil. The seedlings sproudted from seeds hidden in the soil.

Not all plants flower and produce seeds. Nonflowering plants include lichens, mosses, ferns, and mushrooms. Lichens often form greenish-gray crust on rocks or tree trunks. Mosses are low-growing plants that form a green carpet in wet weather but look brown and dead in dry weather. A good rainfall turns them green again. Ferns have thin branching stems and small leaves. They need a good deal of moisture. Mushrooms and other related plants grow on dead and decaying plant material. They, too, need much moisture.

Student Activity (cont.)

Plants protect themselves from harm in different ways. Some plants have thorns or spines on them. These cut and hurt animals that may come near. Look at the plants in a vacant lot and pick out those that have thorns. Do people and animals harm these plants as much as plants without this protection? Of course, thorns don't protect against insects.

Some plants are protected from being touched because they are poisonous in one way or another. For example, contact with the oily sap in the roots, stems, or leaves of poison ivy often causes an itchy rash and blisters.

Poison ivy is a three-leafed vine or thin shrub. The upper surfaces of the leaves are shiny, and they are usually deeply notched. The leaves are green in spring and summer but turn a dark red in the fall. Small white berries also appear in the fall.

If you find poison ivy growing in the lot, stay away from it. Even if the oily sap just gets on your clothing, it may give you a rash if you touch it later. Burning the poison ivy isn't much help. The poisonous oil gets in the smoke and is still dangerous.

Plants are protected in other ways too. Some plants, such as the skunk cabbage, have bad odors. Others, such as milkweed, have bad tastes. Some, such as certain kinds of mushrooms, are poisonous to eat. Many plants have tough woody stems that make eating them difficult.

There are many things you can do to find out about the plants in a vacant lot. Here are some that you might like to try.

Student Actitivy (cont.)

Do plant leaves need air to live? You will need some Vaseline to find out. Find a plant in the lot in an out-of-the-way spot. Cover four of the leaves on the plant on both sides with Vaseline. In two or three days wipe the Vaseline from two of the leaves. Compare the color of the two leaves with that of the leaves that were not covered with Vaseline. Which are greener? Keep the other two leaves covered with Vaseline. After a few days they will turn yellow and fall off. Can you explain why?

Do plant leaves need sunlight? Find out with some black paper and some paper clips. Clip a piece of paper on each side of four leaves. In a few days remove the paper from two of the leaves and compare their color with uncovered leaves. What happens to the leaves that remain covered a few days longer? How do you explain this?

You can show that plant leaves give off water into the air. You will need a plastic bag and a piece of string. Place the plastic bag over some of the leaves and tie the bottom of the bag closed. In a few hours the plastic bag will have a film of water covering the inside. To make sure that it is the leaves that give off water, tie the plastic bag around a twig or other plant part without leaves. See if water forms inside the plastic bag this time.

Can some plants get too much water? Try watering heavily one small plant in the lot every day. Each day compare it with another similar plant. What effect does the watering have? Would the same results be true of all plants?

Student Activity (cont.)

Do some sections of the lot get more sun during the day than other sections? Do the same kins of plants grow in both sunny and shady parts of the lot? If there is a tree growing in the lot, look at the plants growing in its shade. Are these plants the same kinds as those in other shady spots?

Make a collection of different leaves. At home lay the leaves flat between a few sheets of newspaper. Press them down with several books until they dry. If you like, you can wax each leaf by putting it between pieces of waxed paper and pressing it with a warm iron. The dried or waxed leaves can be mounted on cards and labeled. You can use some of the books listed on pages 61-62 or other books in your library to find out the names of the leaves.

STUDENT ACTIVITY

WE KNOW . . .

People enjoy trees along their city streets and in their parks, but the city environment may be harmful to trees.

FIND OUT . . .

What is the condition of trees in your city? What kinds of trees survive best where you live?

CITY TREES

Examine your city's trees

Compare trees in various parts of the city.

Compare street trees with park trees.

Compare a street tree with one of the same kind in a park.

Compare trees in a large park with trees in a small park.

Use these questions to help you make comparisons.

How large is the tree: height, diameter of crown, trunk?

How much bare ground or grass surround the base of the tree?

How much water might soak into the soil around the tree in one year? See Card 8 for the equation for finding annual rainfall which may soak into the soil.

What other sources of water do the trees have? Is there drainage from a nearby hill or sidewalk? Where else?

Compare damage to street trees with damage to park trees.

Make drawings or take photographs of kinds of damage.

Suggest ways to prevent damage to trees.

Student Activity (cont.)

Further Investigations

Identify the trees along the street and in the park. Use a tree book from the library written for your part of the country.

Try to learn from your local department of parks and forestry when the trees were planted and why these kinds where chosen. Which ones do you think might have occurred naturally (not planted by people)?

Which trees bear attractive flowers? Which bear a fruit or nut or other kinds of seeds that birds and squirrels like?

Source: Investigations in Ecology

STUDENT ACTIVITY

MORE ABOUT CITY TREES

City trees are not only beautiful but provide people with shade and air conditioning. Tree leaves give off water. As water evaporates, the air is cooled.

Trees need water, air, and sunlight in order to grow and stay alive. City trees depend on people.

The city environment can be hard on them. Which kinds of trees thrive best?

> In winter streest are salted to melt ice and help prevent accidents. Can street trees be protected from salt?
>
> Tree diseases spread faster when all street trees are the same kind. Why? In some cities all American elm trees have been killed by Dutch elm disease. This is a fungus carried by the elm bark beetle. Spraying to kill the beetles did not help. Why?
>
> Exhaust from automobiles can be harmful to trees. What damage might be the result of automobile exhaust?
>
> Some kinds of trees make problems for city people.
>
> Fast growing trees, such as the willow, are not good street trees. Their roots have many branches and grow rapidly, often entering sewer pipes and causing stoppage. Above ground, their leafy branches are brittle and break easily in the wind.
>
> Trees require maintenance. All deciduous trees lose their leaves. Leaves must be swept from streets. Why.
>
> Conifers (most are evergreen) are perhaps easiest to maintain. They may not be good street trees. Why? They may be good borders for parkways. Why?

Source: Investigations in Ecology

STUDENT ACTIVITY

After you have studied your city trees . . .

Make a list of ways to increase the number of trees in your area and to improve the care they get.

Make a list of those trees you think are best as street trees and those which are best as park trees.

As you make these lists, think about:

Where are the best places for shade trees? . . . for wind breaks? . . . for wildlife? . . . for shielding homes from street noises . . . for making the city more beautiful?

What kinds of trees are best for each of these purposes?

As you make a list of suggestions for maintaining trees, think about:

Planting rees that are most resistant to smog and disease so they will not have to be replanted as often.

Giving trees enough water.

Composting leaves that are cleaned from the streets.

Protecting trees from damage.

Repairing and removing old and storm damaged trees.

Pruning and shaping.

Maintaining nurseries to provide a supply of new trees.

Source: Investigations in Ecology

STUDENT ACTIVITY

ON A STREET NEAR YOUR HOME

1. Take a walk along the roadside near your school. (BE CAREFUL OF TRAFFIC)
2. As you walk along, make a list of things that are growing on either side of you. Find out their names.
3. What patterns do you notice about where the things grow? Draw pictures of your favorite things.

Source: Ecolab

3.1.4.1
SC, MA

Student Activity

LAWN PLANT ADAPTATION

A study of lawn weeds can be conducted by comparing a lawn before and after mowing. Have students determine which of the lawn weeds seem to be most successful in adapting to being mowed. Which growth forms do the successful weeds take? Find examples of rosettes, creepers, or sprawlers.

Source: On Campus Teaching

3.1.4.1.1 Criterion Test: Learning Step

For sixth grade students of environmental studies to develop a knowledge of some of the urban plants cultivated by man so that at least 75% of the students studying urban plants will correctly select from a list of 15 plants the 10 which may be planted in yards or gardens.

Check the 10 plants which may be planted in yards or gardens.

______ pear trees
______ petunias
______ goldenrods
______ sandspurs
______ vegetables
______ pansies
______ golden rain trees
______ thistles
______ tulips
______ flowering shrubs
______ roses
______ poison oak
______ St. Augustine grass
______dogwood trees
______ragweed

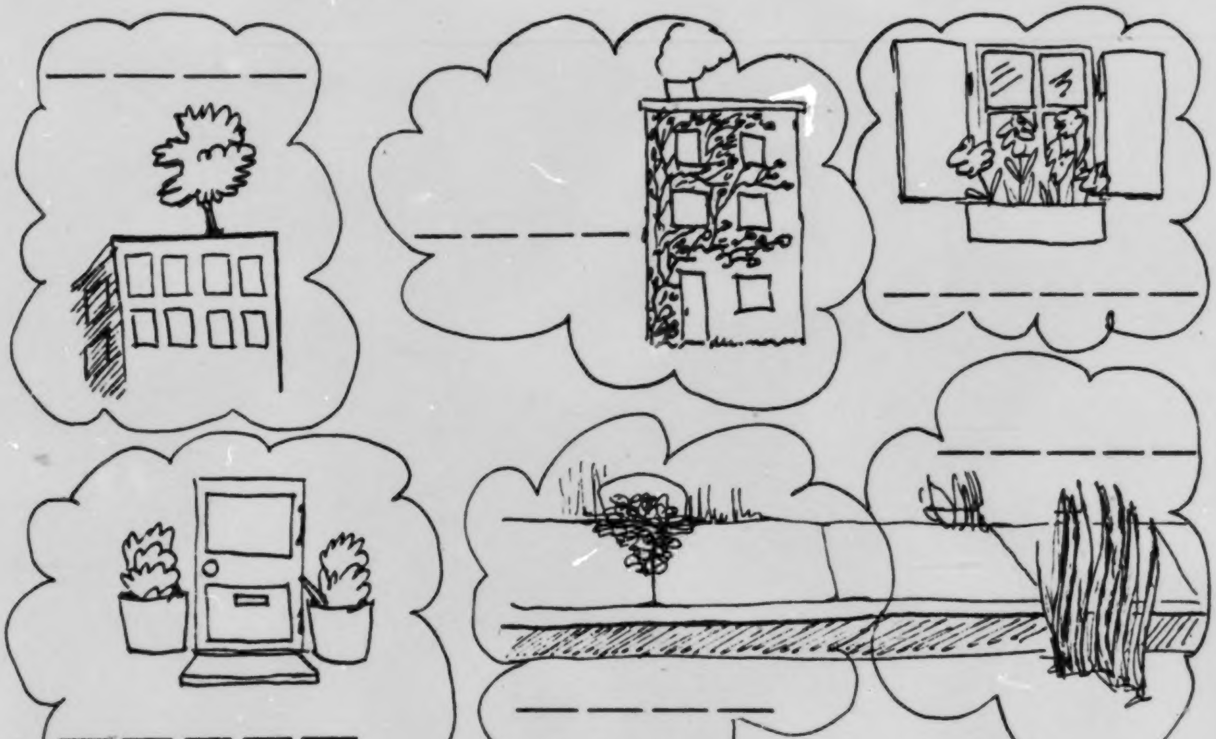
STUDENT ACTIVITY

CITY PLANTS

Most people do not think of a city as a good place to look for plants. But in any city, you can find many different kinds, growing in many different places.

TRY THIS! Unscramble the words below and put the right one in each blank in the picture.

eret shub sosm weflor srags niev



Usually, the trees, bushes, and grass you see were planted by people to make the city prettier and more comfortable. Trees make shade on a hot day and their green leaves add color to city streets. Many animals use them to rest in or as a place to make a nest.

Student Activity (cont.)

Bushes can be planted to hide something that is not pretty or to make a place more private. Flowers and grass make a nice change from hard sidewalks. Plants are not just pretty to see. They can also please your sense of smell and your sense of touch.

Source: A Place to Live

3.1.4.1.2 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop a knowledge of some urban plants that are volunteers so that at least 75% of the students studying urban plants will correctly select from a list of 15 the 10 which may be volunteers.

Check the 10 plants which may be found on a vacant lot.

______ palmetto
______ ferns
______ orange tree
______ toadstools
______ scrub oak
______ poinsetta
______ honeysuckle
______ clover
______ azaleas
______ dandelions
______ wild grasses
______ gardenia
______ magnolia
______ petunias
______ thistles

STUDENT ACTIVITY

Plants in the Vacant Lot

I. Variation in Plant Types

Materials

- tape
- large sheet of paper
- heavy books
- sheet of plastic
- blueprint paper
- dark folder
- bucket of water
- cardboard

Vacant lots usually contain a great variety of plant types. The children can survey the types of plants by forming a plant key. When each team has finished making a plant key it will have a chart that graphically shows all kinds of plants located in its plot. One of the aims here is to help the student discover for himself what a wide variety of plants can be found in a relatively small area of land.

Forming a Key - Here are three suggestions:

Method 1. Each team should search its plot and select one sample of each type of plant. These plants should be taped to a large sheet of paper which is centrally located.

On this central key, only one sample of each plant should be used. The child who brings the first sample of each plant type should invent and draw a symbol to represent that plant type. This symbol should be used during all future studies, mapping, or record-keeping, concerning the vacant lot.

Method 2. Each team should search its plot and select two plants of each type. One of each variety should be taped to a large sheet of

Student Activity (cont.)

paper as in Method 1. The second specimen should be pressed under heavy books for two weeks. This one can then be used to replace the plant which is on the key. (By this time the original plant will be wilted and misshapen). Dried plants will last longer if protected by a sheet of plastic.

Method 3. Each team should search its plot and select one sample of each type of plant. When this has been completed, return to the classroom to make a blueprint of each plant.

Once you are back in the classroom, divide among the students the plants to be blueprinted. The students should have blueprint paper (inside a dark foler to prevent light penetration) and a bucket of water. The blueprint paper should be placed on cardboard, and the plant placed on the blueprint paper. Then the plant should be covered with transparent plastic. Have the students expose the blueprint at a window facing the sun or take the appartus outside. Overhead projectors will substitue for the sun if needed.

The students should hold the blueprint facing the sun for a time period ranging from one minute in bright sun to five minutes on a cloudy day. When the proper exposure has been made, have them remove the blueprint and quickly dip it in water to fix the print.

After drying, the prints can be mounted and assigned symbols. A uniform key should be used for all the maps, charts, or graphs which will be used during the unit. Plant samples can be taped to the key beside its blueprint.

Student Activity (cont.)

Blueprinting the plants makes the key more permanent, and it is fun for the students to do. The blueprinting process might even be expanded into an art project. Some very beautiful effects can be attained using the blueprint paper.

A variety of plant types will probably be found within the lot. Some possibilities are:

clover
plantain
oxalis
white campion
climbing nightshade
deadly nightshade
dandelion
lamb's quarters
wild rhubarb
nettle-leafed goose foot
foxtail
yellow goat's beard
wild grasses
goldenrod
shephard's purse
thistle
wild carrot
milkweed
pigweed

Other plants which might also be found are seedlings from trees surrounding the lot and domestic flowers which have "escaped" gardens.

It is not necessary that the children name the plants for this investigation. A simple pictured "weed" key can be obtained from the library for your own information, if you feel it is necessary. One of these is How to Know the Weeds by H. E. Jacques, Brown Co. Publishers, 1959.

II. Variation Within One Plant Type

Up to this point, the students have made a survey of all the plants within their separate plot. Hopefully, this activity will give them an idea of the great variety of plant types which surround them daily.

Student Activity (cont.)

and measuring each side of the box.

If the students have not yet done so , each team should now select five study plants from its own plot and begin to measure the variation by the sampling method chosen.

Ask the children if any patterns appear. Have they found that short study plants grow generally in one plot while tall study plants are found in another? Are plants with a large leaf area found more in one plot than another?

Try the same sampling procedure with one or two different plant types which exhibit other variations. Data sheets similar to those on the following pages will be helpful. Remember, leaf area and height aren't the only two variations you might study. Ask the students to suggest other characteristics they would like to sample. Mapping procedures described in the back of the book might be adapted to record these variations, and give the class a more complete picture of the range of plant diversity.

More than just measuring variations, the children can also graph these measurements. Area of leaves, height, diameter of stems, etc., can all be graphed easily. A graph composed of class results for one kind of measurement should show a normal curve if enough plants have been measured. (You may be familiar with the normal curve as shown by I.Q. distribution.)

These sampling activities may arouse curiosity about why variations occur. Discuss some theories. (You may want to consult Differences in Living Things. in this series.) If students suggest reasons such as the amount of sunlight , soil moisture, or soil type, encourage them to make observations and collect data to help confirm their theories. Simple tests for environmental characteristics like these can be found in Transect Activities in this series.

Student Activity (cont.)

III. Succession and Seasonal Change

Materials

string
crayons
12" x 12" mapping
   sheets with
   cardboard backing

yardsticks
rope
flags or markers
spikes

The natural change in plant population that occurs over a period of time is called succession. The extent of succession that occurs on a lot during one year will depend upon when and how the lot was cleared. A lot cleared by a bulldozer during the fall or summer preceding your study will show a high degree of succession.

A lot which has been vacant for several years will show less evident succession, and identification of succession on such a lot might not be apparent to all the members of the class. A study of succession during different times of the school year, however, will be enlightening regardless of when the lot was cleared, because seasonal changes are often dramatic.

The most effective way to study succession is to complete separate vegetation maps for fall, winter, early spring, and late spring. Follow the mapping instructions in the back of the book.

Classes during following years will see a broader picture of succession if they can refer to maps and records saved from earlier classes. A very thorough study of succession could result form the survey of a vacant lot for several years after it is cleared.

To make a vegetation map of the lot the students will need to: (1) make a plant key, (2) choose a method for estimating numbers of plants so the class won't have to count each one, and (3) map the vegetation types.

Student Activity (cont.)

(1) Plant Key

A plant key can be prepared using one of the methods found on the first page of this section under Variation in Plant Types.

(2) Estimating Numbers

Encourage each team to devise a key for estimating the numbers of plants in its plot. Obviously, it would be a tedious job to count them all. Then, during class discussion, select the best key. This key should show individual plants, small groups of plants, large groups of plants, and those that completely cover a patch of ground. One uniform key should be used by all the teams.

Your key might be similar to the following:

1-2 plants = red

3-10 plants = blue

11-20 plants = green

thick cover = yellow (crosshatched)

bare ground = blank (white)

A plant is recorded on the map by drawing its symbol from the class key. Use the color which represents plant population density. In the case of thick cover, for example, use yellow crosshatching and draw the symbol for the prevalent plant type in yellow on top of the crosshatching.

(3) Mapping the Vegetation Types

Each group can map the types of vegetation in its plot by using the grid method. If you feel your class needs some preliminary

Student Activity (cont.)

work in gridding before mapping their plots, refer to the back of the book.

Each team should have string, spikes, and 12" x 12" mapping sheets with cardboard backing. Mapping sheets can be made by trimming 12" x 18" drawing paper to 12" x 12" dimensions.

a. Each team should grid its 12-foot square plot into 3-foot square sections. Yardsticks and ropes will aid in setting up the sections. Mark the corners of each section with a spike.

b. Place a flag of some type on one corner of the plot. The first section in this corner is number one. All other sections are numbered consecutively through sixteen.

c. Each group should grid their 12-inch square map into 3-inch square section. These sections are numbered one through sixteen to correspond with the sections of the plot.

d. Using the grid as a guide, draw in all thickly covered areas with yellow crosshatching, as described previously.

e. Draw the sumbols for all other plants in the correct sections using the color which shows their density. If they fall within the corsshatched area, draw their symbol on top of the crosshatching.

When tne maps are complete, start a group discussion about similarities and differences between plots. The students might compile a list of plants which are found in all the plots, plants

Student Activity (cont.)

which are found in most plots, and plants which are found in only one or two plots. These comparisons can be made for all the plot maps of one lot. Comparisons can also be made between lots, if your class is studying more than one vacant lot.

Allow enough time for a complete discussion of similarities and differences. Discussion should stimulate thinking about why plants are distributed in certain ways and how man is involved in this process.

Have the students repeat the mapping procedure several months later. Ask the class: do the maps turn our the same as the ones which were made earlier? Has there been change in the pattern of vegetation? Have some plants appeared that weren't there before? Are bare spots of earth being covered over by plants? What kinds of plants first move onto bare spots? Have some plants moved into plants they were'nt in earlier?

Repeat the mapping procedure a third and possibly a fourth time at intervals of several months.

Source: Vacant Lot Studies

Student Activity (cont.)

Sampling the Study Plant

The plants chosen for measurement should be selected at random. If you were to look specifically for certain plant variations, you may tend to select plants that exhibit extremes of the variation being considered. You might choose for example, those that are quite tall or quite short, without intending to do so.

Each group will study five specimens of the same plant. Try to reach a group decision about the best way to choose these five plants at random. The students might close their eyes and feel for the plants; they might toss a ring or some object, and see if it lands touching a plant of the right type; they mught cross two strings from corner to corner on their plot and measure only study plants which touch the sting. Hopefully, the students will suggest inventive ways to sample their selection. Choosing a random sampling method might be best done as a pencil-and-paper exercise in the classroom, because more unbiased sampling methods seem to be produced when planned in a separate location.

Measuring the Variation in the Study Plant

After the students have selected and identified the study plant and the characteristics which they want to investigate, begin a class discussion about how to measure the variation. This is necessary because, in order to produce valid conclusions, everyone must use the same measuring technique.

For example, the height of a bushy plant might be measured form the ground to the topmost branch; the size of the leaf might be measured by counting the number of squares it covers on graph paper; the amount of ground covered might be measured by "boxing in" the plant (using a group-chosen method).

Student Activity (cont.)

Now we want to choose one kind of plant and examine the variations among several specimens of **that type.** The various specimens of a single plant type will vary in height, maturity, size of leaves, and other characteristics, depending on their locations on the lot. The students will notice this and should be encouraged to suggest reasons for the variety. They may observe that one plant in a species is larger and more healthy-looking in shady areas of the lot than is another of the same species in sunny areas of the lot, or vice-versa.

Take advantage of these observations to lead the students into more quantitive studies. You might start off, for example by asking what the exact difference in size is between the plants of a particular species when found in the shade and when found in the sun.

Many problems will arise during a study of plant variation. The appropriate number of samples must be determined; the correct spots for sampling must be selected; and all contributing factors must be considered above and beyond the required amount of sunlight. Here are some suggestions for collecting valid data on variation occurring within one plant type.

Select a single plant type which shows some obvious variation and is distributed through many plots. Variation might be in the size of the leaf, the amount of ground over which the plant spreads, the height or anything else which the children have already noticed varying greatly among the individuals of a single type.

Choose only one characteristic to study at a time. The children will be responsible for gathering samples of the study plant and and measuring the variation within their own plot.

STUDENT ACTIVITY

DANDELIONS SURVIVE IN MANY HABITATS

Observe and record the appearance of dandelion plants in several different kinds of habitats: mowed lawns, unmowed border, shaded and sunny places, moist and dry soils, loose and hard packed soils.

First observe the plant where it is. Then, if you wish, dig it up. Try to dig up the whole root. Digging dandelions out of lawns will probably be appreciate. Remember, fill the holes you make.

In order to make comparisons, record your observations on a chart like the one on the back of this card.

Try to explain the differences you see. In what kind of habitat did you see the tallest plant?. . . the flattest plant? . . . the one with the most leaves? . . . the one with most rosettes of leaves on one root? . . . the most buds or flowers? . . . the least buds or flowers?

How are the plants in the mowed lawn different from those in a place that in not mowed? Form a hypothesis to explain why tomato plants, petunias and marigold do not survive in a mowed lawn.

We Know . . .

Dandelions are common plants in many lands around the world. They can survive in a variety of climates and habitats.

Find Out . . .

What is it about dandelions that makes them so successful? In how many different habitats can you find them growing? How does the form of the plant differ in different kinds of places?

Source: Investigations in Ecology

Student Activity (cont.)

Further Investigations

Population Density

Find out how many dandelion plants there are in an area.

The number of dandelions is a measure of the success of their way of life.

Measure and mark ten plots one yard square or one meter square. The greater the number of plots, the more reliable the results.

Count the number of dandelion plants in the squares and find the population density.

$$\text{Population Density} = \frac{\text{Total number of plants in all plots}}{\text{Total area of all plots}}$$

For example, if dandelions were counted in 10 plots of one yard square each, the result is stated this way: The population density of dandelions in the study area is the average number of dandelions per square yard.

Calculation of above result:

$$\text{Population Density} = \frac{\text{Total number of plant in 10 sq. yds.}}{\text{10 sq. yds.}}$$

Measure the population density of plantain, or another lawn weed, and compare it with that of the dandelion.

Source: Investigations in Ecology

3.1.4. 2 Criterion Test: Learning Step

For intermediate grade students of environmental studies to develop an ability to recognize urban animals, their habitats, food, and adaptations, so that 75% of the students studying urban animals will correctly answer 8 our of 10 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. A common urban bird is a

   a. hawk
   b. sparrow
   c. crow

2. Pigeons have adapted to urban living by building their nests

   a. in trees
   b. on the ground
   c. on buildings

3. When people crowd together in cities, rats and roaches crowd into the same area. This may cause harm to man because rats and roaches

   a. eat scraps
   b. carry disease germs
   c. frighten people

4. Snakes may be found in areas occupied by rats because

   a. snakes may eat rats
   b. rats eat snakes
   c. rats carry germs

5. Gulls help keep waterways clean by

   a. killing fish
   b. roosting on boats
   c. eating garbage

3.1.4.2 Criterion Test (continued)

6. Dogs and cats which live wild in big cities cause problems by

   a. protecting their masters
   b. tipping over garbage cans
   c. keeping the streets clean

7. Spiders are helpful to man because they

   a. make silk
   b. eat insects
   c. bite people

8. Wooden houses and buildings can be destroyed by

   a. termites
   b. earth worms
   c. toads

9. Cities pass laws requring rabies shots for dogs and cats to

   a. prevent ticks and fleas
   b. protect animals and people
   c. raise money

10. Many city animals find homes in vacant lots because

   a. many people are found there
   b. it rains often
   c. they find protection there

STUDENT ACTIVITY
(Reading)

Animal Visitors

From time to time you may see dogs, cats, squirrels, and rats and mice in a vacant lot. Perhaps you may even find someone's escaped pet, such as a turtle, a hamster, or a snake. Look for holes or burrows in the ground that these animals might use.

Dogs and men have lived closely together for a long time, perhaps ten thousand years or more. Dogs helped man in many ways. They guarded his home and family. They helped to protect his herds. They hunted with him. They became his friends.

Nowadays dogs that live with people in a city don't have all these jobs to do. Many dogs bark at strangers and will protect their masters, but most dogs today are kept just because of the friendship they offer to man.

The dogs that you see in a vacant lot usually come with their masters. Watch how they act. They run around sniffing, tails wagging, scratching, barking, and so on. Perhaps you may see a dog bury some food in the ground.

If the dog comes near you, don't make sudden movements. Talk softly to it and let it smell your fingers. Ask the dog's master if you may pet it. Don't try doing any of these things with a stray dog. A stray may be unfriendly to people and can be dangerous.

Dogs find out many things by using their noses. Watch how a dog sniffs at something to identify it. The master allows a dog to smell a stick and then throws it away. If the dog doesn't see where the stick lands, it may locate it by its odor. A dog can often tell an article of its master's clothing by the way it smells. Dogs seem to enjoy running around a vacant lot. You can enjoy watching what they do.

Cats have also lived with man for a long time. But while dogs seem to have lost much of their wild past, cats become wild more easily. You won't find too many stray dogs around, but almost every neighborhood has lots of stray cats.

Watch how a cat walks through the grass in a vacant lot. It looks like a miniature tiger. See how it stalks its prey--a mouse or a large insect. The cat creeps up quietly, one foot at a time. Its eyes stare unblinkingly at its victim. Its tail twitches back and forth. Suddenly it pounces, claws extended.

Cats can take care of themselves in the city. When they become wild, they don't need man and will have nothing to do with him. It is a good idea to have nothing to do with such cats. They won't hesitate to scratch or bite.

Many of the stray cats in a city live by hunting rats and mice. Stray cats mate, have kittens, and often the kittens become strays too.

Without cats, rats and mice would be even more of a serious problem than they are now. You may not see a rat or a mouse in a vacant lot; but whether you see them or not, they are there.

Rats are nighttime animals. When darkness falls, rats come out of their holes from inside the walls of houses, from the sewers, from garbage piles, from dark underground places all over.

Most of the rats in a city are Norway rats. They also have other names such as sewer rats, brown rats, and house rats. A Norway rat weighs about one pound, and its body is from eight to eighteen inches long. Its naked, scaly tail is shorter than its body, about six inches long. The fur is usually matted and grayish- or reddish-brown.

Rats breed very quickly and in great numbers. A rat may have six litters a year, usually with eight to twelve in each litter. The young are born blind and without fur, but their helpless state doesn't last for long. After one month they are out on their own. After three or four months they can mate and produce young. One scientist figured out that one pair of rats could multiply to one hundred billion in a little over five years if conditions were right. Of course, things are never that good for rats. Disease, shortage of food, and enemies such as cats and man all take their toll.

But the rats that do live are bad enough. Rats eat and spoil millions of dollars worth of food each year. A rat's teet grow several inches each year. To prevent its teeth from become too long, the rat must constantly gnaw at hard objects. Rats gnaw through cardboard boxes, walls, even tin cans and lead pipes. They eat almost anything and will gnaw through almost anything to get at food.

Not only do rats eat our valuable food, but they also carry diseases. Either by carrying germs on their bodies or by way of the lice and fleas that live on them, rats have spread typhus, plague, rabies, and other diseases, including rat-bite fever. A cornered rat will turn and bite a man; they also bite infants and other helpless people.

Man fights against rats by using special kinds of poison. New concrete buildings are ratproof. But the best way to control rats is by seeing that they have as little food as possible. This means putting garbage in pails and keeping the lids on tight. It means getting rid of rubbish so that rats cannot live there. It means putting food in containers and not leaving it out in the open. These things may not get rid of rats completely, but they will help.

Mice are another kind of animal that lives around man. You are more likely to see a mouse in a vacant lot than a rat. Mice are smaller than rats. The common house mouse is about four inches long and has a three-inch tail. Its color is brownish-gray to light black. It roams around mostly at night, but you may see it going from one place to another during the day.

Mice breed almost as quickly as rats. A mouse is able to breed at two months of age. Within one year a single pair of mice can multiply to over one thousand.

Mice are not as vicious as rats. They don't often bite people. But they are a serious nuisance anyway. They damage food and clothing. They carry many kinds of disease. One kind of house mouse is helpful to man, however. That is a special strain of white mouse used in many scientific experiments.

Squirrels are related to rats and mice but are much nicer animals as far as man is concerned. Squirrels live in trees, eat acorns and seeds of all kinds, and are lively, interesting animals to watch.

Gray squirrels are the kind you're likely to see in a vacant lot. Watch them chattering away, chasing each other up and down trees, and nibbling at nuts. Squirrels in the city often become friendly enough to eat peanuts or bread crumbs out of people's hands. This is not a good idea, however, because a squirrel can accidentally give you a nasty bite.

Squirrels sometimes eat food that is put out for birds. For this reason a bird feeder often has a shield or guard built on it to prevent squirrels from getting at the food. The guard is not usually successful, though. Squirrels are very acrobatic and can get around most guards

Squirrels nest in holes in trees or make nests out of leaves on a high branch. You can see their nests easily in the fall and winter, when the trees are bare. Young squirrels are often born in the summer. When they are six weeks old, they leave the nest and begin to look for food themselves.

STUDENT ACTIVITY
(Reading)

How Rats Made Themselves at Home in the Cities

Animal pests join pollution as a serious problem in the city. Of all the animal pests, none cause more damage or danger to people than rats. Two kinds of rats have moved from wild homes to live in man's home in the city.

The black rat once lived in the jungles of Indonesia. In its wild home, it lived in trees eating fruits and seeds. When ships began to visit the islands, the black rat climbed aboard and was carried back to Europe. There it left the ships and began to live in the cities. Instead of climbing trees, it climbed around in buildings.

The brown rat came to Europe from the grasslands of Asia. When it lived on the grasslands, the brown rat dug holes in the ground to live in. And when it got to Europe, it found a good home in cellars and sewer pipes.

The brown rat is much bigger and stronger than the black rat. And where the two have met, the brown rat usually has driven out the black one. But whether a city has brown or black rats also depends upon the way the city is built. If a city has lots of cellars and sewers, the underground brown rat finds a better home. When cities begin to fill up with concrete buildings connected to each other by electric and telephone wires, the black rats increase in number.

Damage and Disease Caused by Rats

As they try to get food, rats chew holes in buildings and even cut through wires and cause electric fires. They will eat almost anything people eat, as well as some things that people don't like, including soap and candles. A rat is able to chew into a tin can, if it is really hungry. And it is usually hungry. Each day a rat may eat food equal to one-third of its weight.

A rat can go for a long time without food. But the hungrier it gets, the more dangerous it is. Hungry rats will creep into houses and attack sleeping children.

Probably the greatest danger from rats is that they carry diseases that affect people. One of these is the bubonic plague you read about earlier. But rats carry many other dangerous sicknesses, including typhus and rabies. Luckily, the brown rat is less often a disease carrier than the black. And in most modern cities, the brown rat is by far the most common kind. However, in some parts of the world, scientists have noticed the number of black rats is getting larger as tall buildings become more common.

People spend millions of dollars each year trying to get rid of rats. They are trapped, poisoned and gassed. But killing a few of the animals never solves the rat problem. The rats have few animal enemies in the city, and as long as the rats can find food and places to live in cities, they will be there. Certainly people will have to be more careful with garbage. And buildings will have to be made of strong materials that rats cannot bite through.

STUDENT ACTIVITY
(Reading)

The Cockroach, An Old and Unwelcome Insect

The cockroach is one of the oldest insects on Earth. Fossil cockroaches have been found in rocks millions of years old. No one knows when cockroaches first moved in with people, but it was probably very early. The roach doesn't need a fancy place to live. It has even been found in the nests of apes.

What is it about cockroaches that makes them so much at home with people? For one thing, roaches eat many kinds of food. If a cockroach liked only plant juices, it would probably move somewhere else. But a roach will eat almost anything people do and many other things besides. Their diet can include bread, potatoes, garlic, onions, chocolate, fats, sugar, ink, shoe polish, soap, and paper. They will even eat the covers of books and the gold print on the covers of the books.

The cockroach has a slim, flat body that helps it to hide in cracks and under things. Mostly it is a night insect. If you turn on a light, roaches will run back to their shelter as quickly as possible. They are fast runners for small bugs. A roach can travel about one mile an hour.

Cockroaches also have many babies. The females lay from 50 to 100 eggs each month. The babies are so tiny that they can crawl through cracks that big roaches can't squeeze through. That is why is is so hard to keep roaches out of a house. Within about six weeks, the female baby is grown up and ready to lay eggs.

Cockroaches are not welcome visitors in human houses. Many people simply don't like living around bugs. And cockroaches may also damage books and other things around a home. But cockroaches carry diseases too. They pick up bacteria and viruses on their legs and mouths and carry them from one place to another. If the roach touches food or dishes, it may spread the disease to people.

STUDENT ACTIVITY
(Reading)

Insects and Other Creeping Crawlers

Turn over a large flat rock and look beneath it. You probably will find a number of crawling, creeping, and wiggling animals. Beneath your feet in the soil of a vacant lot live many different kinds of insects, spiders, centipedes, millipedes, snails, earthworms, pill bugs, mites, and many other living things too small to see without a microscope.

Look for these animals beneath rocks, old logs, and pieces of rotting wood. Put your eyes close to the ground and look for ants and spiders making their way through the tangled plants. Listen for the sounds of insects on a hot summer day.

Spread out several sheets of newspaper on the ground. With a shovel, dig up a square foot of soil to a depth of six inches. Spread the soil out on the newspapers. Look for movement in the soil. Count the number of different animals you find. You may be surprised to find out how many there are.

You might like to take home some of the soil and place it in a wide-mouthed glass jar or a small aquarium. Keep the soil moist but not soggy. Cover the top of the jar loosely, so some air can get in. Observe the soil daily for signs of animal life that you did not notice before.

Of all the different kinds of animals in the world, the largest group by far is insects. About 80 percent of the different kinds of animals are insects. There are roughly three quarters of a million different kinds of insects known today, and thousands of new ones are discovered each year. They don't all come from strange, distant places either. In New York City, for example, over 15,000 different kinds of insects have been found.

You probably know many kinds of insects, such as ants, flies, termites, cockroaches, butterflies, moths, and beetles. But how can you tell whether a new small creeping animal that you spot is an insect?

Scientists group together animals which are alike in important ways. They don't do it just by how many legs an animal has, or how it moves. They want to know as much as they can about the animal, both inside and outside. They they decide which ones are most alike in body makeup and in the way their bodies work.

With so many different kinds of insects you can expect to find many differences among them. But all insects are alike in certain important ways. The body of an adult insect is divided into three parts: the head, containing the eyes, antennae, and mouth parts; the thorax, which has three pairs of jointed legs and often one or two pairs of wings; and the stomach or abdomen, which contains organs of digestion and reproduction.

Insects go through different stages in their lives, during which their body shape changes. Insects that are not yet adult may look quite different than they will in later life.

Most insects go through four different stages. First there is egg. Eggs are small and not easily noticed. They come in many different colors and shapes. Often they are clumped together.

Sometimes they are left on leaves or twigs or in the soil. If you find a cluster of tiny rounded objects, they may be insect eggs. Take them home in a small jar. Keep the jar loosely covered. Observe the objects each day to see if anything hatches.

An insect egg hatches into a wormlike form called a larva. Caterpillars and the "worms" in apples are examples of larvae. You can often find larvae eating the leaves of plants. In fact larvae eat and eat and eat. In a few weeks they usually grow large and fat.

You can collect a caterpillar and observe it in your home. Put it in a glass jar along with some of the plant material you find it feeding on. Use an old nylon stocking to cover the top so that the caterpillar cannot escape but air can enter. Every few days put in some fresh plants for the caterpillar to eat.

After a while the caterpillar will stop eating. It will begin to spin a cocoon around itself. Inside the cocoon its body shape changes, and it becomes a pupa. Some insects become pupae without spinning cocoons. Within the pupa great body changes are going on. The pupa is usually motionless and does not eat.

The adult insect emerges from the pupa. With some insects the pupa changes into an adult in a few days. In other insects the change takes a few weeks or even all winter long. You can collect different kinds of cocoons and keep them until they hatch. Most cocoons are drab-looking and difficult to spot. Look for cocoon cases on twigs, leaves, and bushes.

Adult insects are easier to find. Here are some that you will probably see in a vacant lot.

Beetles are very common. There are more kinds of beetles than any other insect. In fact there are more different beetles than all the kinds of mammals, birds, fish, reptiles, and amphibians put together.

The front pair of a beetle's wings are hardened into shields that fold over its body. You may find ladybird beetles, leaf beetles feeding on plants, longicorn beetles with their long antennae, and wood-boring beetles.

Butterflies and moths have two pairs of wings covered with tiny scales. Usually a moth has a fatter body than a butterfly and comes out in the evening, while a butterfly is about during the day. A moth's antennae are often feathery, while a butterfly's antennae are usually thin.

Ants, wasps, and bees usually live in large groups called colonies. These three are the only insects with stingers--so don't grab for a bee or a wasp with your hands. An ant's stinger is not usually so dangerous. Look for ant nests under large rocks or in rotting wood.

Flies come in different sizes and colors. They all have large eyes and small antennae.

Other insects that you may find on a lot include grasshoppers, mantises, crickets, termites, aphids, cockroaches, and lacewings.

You can keep some of these adult insects as pets. A praying mantis makes an interesting pet. Place one in a glass jar along with some twigs. Cover the jar with something so that the mantis cannot escape but air can pass through. Feed your mantis small live insects. Watch how it uses its front legs to grasp the insect. From time to time sprinkle a few drops of water in the jar.

Ants may be even more interesting to keep and watch. You will need a large wide-mouthed glass jar and its cover. Find an ant nest in a piece of rotting wood or in the ground. Quickly collect plenty of ants, ant cocoons, eggs, and some of the wood or the soil. Place them in the jar and cover them. Some of the ants will probably run out of the jar, but just keep collecting. If you find a very large ant, take it. It may be a queen.

At home, cover the sides of the jar with black paper. Place the jar in a flat pan half-filled with water to prevent the ants from escaping. Remove the jar's cover. Sprinkle a few drops of water on a piece of sponge and place it in the jar. Feed the ants on a bit of potato, bread crumbs, a drop of jam or jelly, and a dead soft-bodied insect or piece of worm.

Remove the black paper when you want to observe the ants. You will see them tunneling in the soil and caring for the eggs and cocoons. Your ants may live for many weeks, but without a queen the colony will die after a while.

Not every small crawly animal is an insect. Spiders are not insects; they belong to a class of animals called Arachnida. They have two body parts and four pairs of legs, rather than an insect's three body parts and three pairs of legs. Spiders also differ from insects in having several (up to eight) simple eyes. Insects have a pair of many-sided compound eyes.

Spiders eat insects and are very helpful to man because of this. They have fangs which are used to inject poison into their larger prey. Most spiders cannot hurt you in any way. One exception is the black widow spider. You probably won't come across a black widow; but if you do, you can recognize it by its deep black color and a bright red hourglass marking on its underside. It is about a half-inch long.

You can find a spider most easily by looking for its web. Look for webs on bushes or in grass. Spiders make their webs from silk, which they spin from a liquid made in their bodies. The silk threads come out of a set of openings in the spider's abdomen. The silk can come out in different ways--as flat bands, fine strands, or thick cables.

Spiders use silk not only to make webs but to make sacs for their eggs, as anchor lines, and as parachutes or balloons. A young spider launches itself into the air at the end of a long silk thread. You can sometimes feel a spider's silk thread when you accidentally brush against it.

Most spiders trap the insects they eat in their webs. But some spiders hunt their prey without spinning webs. You may find these wolf spiders and jumping spiders in the undergrowth of the lot. Jumping spiders are active in daylight and are often brightly colored.

Wolf spiders are drabber looking and hunt at night. A daddy longlegs, by the way, is not really a spider at all. It belongs to a closely related group of jointed-leg animals whose bodies appear to be one solid part.

The bodies of centipedes and millipedes are made up of many parts or segments. Centipedes have one pair of legs for each segment, while millipedes have two pairs of legs for each segment. Centipedes prey on insects and have poison fangs formed from the first pair of legs. A large centipede can give you a nasty bite, so handle it carefully. Millipedes eat only plant material and are slow moving. It's fun to watch either of these animals move. Sometimes their many legs seem to trip over one another.

Snails, slugs, earthworms, pill bugs, and other kinds of small animals can often be found under heaps of rotting plants or decaying wood. You have only to look around.

STUDENT ACTIVITY
(Reading)

The Pigeon, A Country Bird that Moved to Town

Pigeons are probably the commonest birds in American cities. Like most of the people in the cities, pigeons came to America from another country. The pigeon is a European bird. Originally, it lived wild along the European coast, where it built nests on the cliffs and flew down to the ground for food. It would eat many things, including worms, seeds, insects, fruits, meat, and fish.

A long time ago, people caught some of the pigeons and began to raise them for food. Mostly it was the baby pigeons, or squabs, that were eaten. When people began to live in cities in Europe, some of the tame pigeons probably escaped and began living wild in European cities. American pioneers brought pigeons to this country for food. Probably some of those birds got loose and began to live in towns and cities in America.

Perhaps you can see how pigeons might feel at home in a city. Instead of cliffs, they have high buildings to nest on. And they can fly down to the ground to eat all the kinds of food people in a city might throw away. A bird that nested in hollow trees and ate only certain kinds of bugs would never become a city bird. But the pigeon made an excellent one.

There are other things about pigeons that help them get along well in a city. For one thing, they are not very afraid of people. Any bird that flies away the minute a person comes near would never make a good city bird. On the other hand, pigeons do not trust people too far. You can walk right up to a pigeon, but if you make a sudden move, the bird flies away. Even when a pigeon comes down to eat out of your hand, it is always ready to leave if you make one wrong move. Pigeons have just the right balance of fear and trust for living with people.

The Daily Life of a City Pigeon

The pigeons in a city are usually divided up into separate flocks. Each flock has a section of the city where it nests and finds food. Neither the size of the flock nor the territory it lives in stays the same all the time. Sometimes pigeons go from one flock to another if food in one territory gets hard to find.

The pigeon flocks get up very early in the morning and start to hunt for food. Pigeons have very good eyes, and they spot every crumb on the ground. They also get used to going to the same place each day for food. If a person puts out food for the birds at the same time and place each day, the flock will always be there waiting. Sometimes a flock will have four or five different places where they are given food each day. They are always at the right place at the right time.

Of course, many pigeons get killed in a city each day. They are trapped and poisoned. Cats, dogs, and rats eat them. And many are killed by cars. But the number of pigeons seldom gets smaller. One pair of pigeons may raise six families a year. And each family usually has foud babies. Pigeons often nest together in groups, and if they find a good place to nest, they may come back year after year. A very old nesting place may be full of dead and decaying pigeon bones and feathers. The live pigeons lay their eggs and raise their babies on this pile of filth.

Because so many pigeons live so close together in these dirty nesting areas, they may pass diseases to one another. One pigeon disease causes a serious disease in human beings. Often cities try to get rid of their pigeons, but it seems like an impossible job.

These birds are very good at escaping danger. And many city people like to have the pigeons around. These people complain each time the city government tries to cut down the size of the city's pigeon population.

STUDENT ACTIVITY
(Reading)

Bird Visitors

Look for signs of bird life in a vacant lot. You may find feathers on the ground, an abandoned nest in a tree, or bird tracks on the ground. You may hear the sounds of birds in the air. Look for birds hopping or running along the ground, moving through the bushes and the grass, or sitting on a tree branch. It won't take you long to spot a bird somewhere.

One city bird that you're almost sure to find visiting the lot from time to time is the pigeon. Pigeons nest on the ledges of buildings and other high places, but they search everywhere for food. Food for a pigeon is just about anything: seeds, insects, earthworms, scraps of meat or fish, whatever is around.

Pigeons are large chunky birds. They are usually gray or blue, but you may see other colors as well. Their feet are red, and their bills are black. Look for their three-toed tracks in snow or mud.

Pigeons have remarkable eyesight. They will feed on a crowded street among rushing cars, trucks, and people and just avoid getting hit at the last moment. If you feed them bits of a cracker or a piece of bread, they will spot every last crumb.

Pigeons are not as afraid of people as many other birds. You may see someone feeding pigeons out of his hand. But this trust only goes so far. If you've ever run after a pigeon, you know that you just can't catch it.

Pigeons lay two to four eggs almost any season of the year. They may raise more than one brood each year. In New York City alone some scientists think that there are a quarter of a million pigeons. Pigeons have multiplied and spread since migrating to the United States with the early colonists. They originally came as domestic animals, but many became wild.

You'll most often see pigeons traveling together in flocks. The size of the flock seems to depend on the amount of food available. If a single pigeon finds some food, it won't be long before he is joined by other birds in the flock.

Another city bird that travels in flocks is the starling. A starling is smaller in size than a pigeon; it may travel in even larger flocks. A mature starling is shiny black with white spots on its back. Its bill is yellow in summer and darker in winter. A young starling is as large as an adult bird but is gray and spotted with white.

Starlings were imported into the United States from Europe in 1890. Sixty and they forty more starlings were released in Central Park in New York City. From this small band of one hundred birds have come the millions of starlings now found all over the country.

Many large flocks of starlings live in the heart of big cities. Each morning they scatter to the outskirts of the city in a search for food. It is these large central flocks of starlings that have given the bird a bad name in some places. In one place the birds gathered in such numbers on the hands of the city clock that they stopped it from moving.

The third city bird you're liable to see is the English sparrow or house sparrow. Like the pigeon and the starling, the house sparrow was also introduced into the United States. It was released in Brooklyn, New York, in 1850. By 1900 the sparrow was the most common bird in the cities. But since automobiles took the place of the horse in transportation, sparrows are not as numerous as they once were. Horses eat oats and other grains. As horses disappeared there was less grain for the sparrows to feed upon. This resulted in fewer sparrows. But they have found other sources of food and are still around in good numbers.

The sparrow is a smaller bird than either the pigeon or the starling. It has a brown back and white and black underparts. Sparrows travel in small flocks. When they land in a vacant lot, you'll see them hopping around and chirping as they search for food. Besides grain, sparrows eat seeds, fruit, insects, and scraps of food from garbage.

Sparrows nest almost anywhere: fire escapes, ledges, holes in trees, and buildings of all kinds. Three to six grayish-white eggs speckled with dark green are laid in the nest. Young birds soon begin to travel with the flock and are fed by all the adults in the flock, not just the parents.

You may see other birds from time to time in a vacant lot. Look for robins searching for worms and other insects. Blue jays are large birds with a crest atop their heads. Crows, wrens, blackbirds, chickadees, catbirds, and woodpeckers are other possible visitors.

Spring and fall are the best times of the year in most parts of the country to look for birds. During these seasons many birds are passing through on their migrations to the north or to the south. But even during the winter there are birds about. In fact you'll always see more different kinds of birds in a vacant lot than any other larger animals.

All birds have feathers, two wings, and two legs. They all lay eggs and are warm-blooded. But beyond this birds differ from one kind to another. You can learn much about these differences by careful observation.

Here are some of the things to look for. How large is the bird? Compare it to another bird such as a robin or a sparrow. Is the bird alone or in a pair or in a flock? What is its shape and color? Does it have special markings on its body such as stripes or spots? Does it fly in a straight line or move up and down? Does it hop or run on the ground or perch on the side of a tree? What kind of food does it seem to eat? What shape and color is its bill? What kind of sounds does it make?

These observations will tell you about the bird's habits and will also help you identify it. Don't be discouraged if at first you can't tell which bird is which. Keep watching and making notes, and you will soon be able to tell one kind from another.

Birds are one of the few kinds of larger wild animals that you can observe every day in a vacant lot. Here, even in the midst of a city, they will go about their daily activities just as if no one were there to watch. Birds bring nature a little closer to city dwellers.

CITY BIRDS

Choose one kind of city bird to study: pigeons, starlings, house sparrows, or other birds common to where you live. Where do they nest and rear their young? Where do they roost at night and in cold weather? Look in the ivy vines that cover the walls of some old buildings. Look at the trim around doors and windows and under the eaves.

Watch the birds eating. Make a list of the foods you see birds eating. In what kinds of places do you see most birds? When you go to the zoo or the park, notice where you see the pigeons, starlings, or sparrows. What are they doing?

These birds are said to be man-tolerant. After you have watched them, try to explain what man-tolerant means. How do man's buildings and man's activities improve the environment for these birds?

There are fewer birds around some of the newer buildings. Compare these new buildings with old ones. Try to explain why fewer birds are found there.

FURTHER INVESTIGATIONS

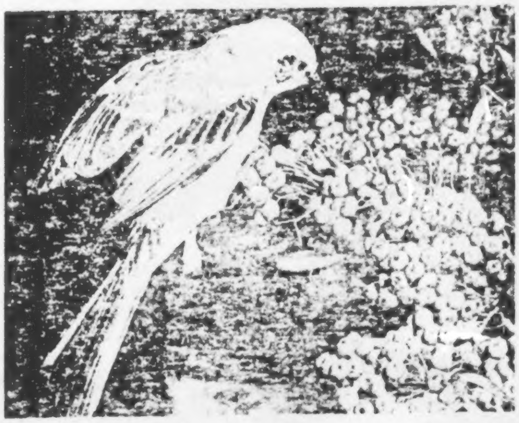
A few other kinds of man-tolerant birds might live in cities. These are interesting to study too. Night hawks (not really hawks, but related to whippoorwill) nest on flat roofs. They are seen and heard during the evening as they swoop over the streets catching insects. They do not stay in town during the winter. Sea gulls are attracted to cities near the ocean. If you live near the ocean, try to find out what attracts them.

During spring migration, many kinds of birds stop to rest and feed in the city parks. Perhaps a few kinds will stay in the park to nest. People who like to watch birds will help you see the migrants and find out where they spent the winter and where they are going for the summer. Why don't these birds stay in the park all summer?

Some birds are not shy of other animals. This may explain why some birds will live near people. Test a bird. Keep very quiet and do not move your arms. Walk ever so slowly toward a bird. How close can you get to it before it flies away? Try this with several kinds of birds.

To Help You Know What To Watch:

Lubell, Winifred and Cecil. Birds in the Street,
The City
Pigeon Book, Parents Magazine Press. N.Y. 1971
Summers-Smith, D. The House Sparrow. William
Collins Sons & Co., Ltd., London. 1963



Source: Investigations in Ecology

City Plant and Animal Life

An elementary class might undertake an "ant hunt" and locate sites on or near the schools grounds where colonies are found. Individual or small groups of students can study ant behavior regarding such things as strength, food preferences, touching antennae, etc. Where and why do ants live as they do?

Pigeons on or near school property as well as near the apartments where some pupils live might also be studied. How and why the pigeon fits so easily into the city environment will easily become a natural topic for study.

On or near the school ground will likely be found some flowering tree (in spring) or small plants which are visited by bees or yellow jackets. The conditions necessary for life of these organisms and the interrelationships among them might be discussed just as insightfully in this urban setting as in a rural one.

Source: 100 Teaching Activities in Environmental Education

Visitors to the Vacant Lot

1. Burrows

The teams should check the plot carefully for burrows and tunnels. Have the students look: (1) atound the base of fences; (2) around and under cement blocks, bricks, large stones; (3) in hollows, ground depressions, sides of banks; (4) around tree roots, under clumps of vegetation; and (5) under matted grasses.

The students should make notes on the appearance and diameter of a burrow. They should locate and count all similar burrows found throughout the plot. Are they all found in the same kind of surroundings? Have the class map the locations. (See the back of the book for instructions on mapping.)

2. Droppings

Have the students find out what animal droppings can be found on their plot. Do dogs leave droppings there? Do they use one particular part of the plot, or all of it? If one part of the plot seems to be used heavily, have team members study its characteristics. Can the students explain why this section would be used more than other sections? Have they seen the dogs using this spot?

Have the team members check around the entrances of the burrows they located. Can they find any droppings? Ask the class why an animal might come outside to defecate. If the droppings are small and dry, collect some in a plastic bag and label them with a description of the burrows found nearby. Are the same deoppings found near other burrows? Does this evidence provide clues about what kind of animal lives in the burrows?

Rabbit droppings are black-brown, round and peasized. If the class finds any, have each team collect some in a plastic bag. Label them, indicating where they were found.

The students should look for bird droppings on the tops and sides of fences, boards, rocks, broad leaves, and other flat surfaces. What seem to be favorite perching areas? Ask the class what reasons a bird might have for choosing a particular perch. (Safety? Food?) Watch these perches to observe the birds which frequent them.

3. Other Signs of Animals

MATERIALS

food-raw meat, oatmeal peanut butter, fine
powdered soil, flour, or unscented talcum
shelf paper
small garden trowels
clipboards
graph paper
water
detergent
soup or juice cans
fly paper
tiles or flat boards
alcohol
white liquid glue
cardboard

BIRDS:

Watch the birds closely and see what they do when they come to the lot. Ask the students why birds might visit the lot. Are there trees or bushes for nesting? Are there weed seeds, berries, or insects for feeding? Have the class watch for bird nests or birds feeding. If there are different kinds of birds in your lot, do they have different reasons for being there?

CATS:

Ask why a cat might visit the lot, and what implications his presence has for the rest of the animal life there.

TRACKS AND FOOD:

The students can prepare a list of foods which might be eaten by animals that visit the lot, and each student can bring some of the foods from home. Foods which might be used are: raw meat to entice dogs, cats, rats, shrews, and scavenger birds; oatmeal or peanut butter mixed with seeds, to attract mice, moles, shrews, rats, birds, and possibly cats and dogs. Any insects which collect in and around the food could also be studied. Place these foods not closer than three to four feet from each other.

The tracks of visiting animals can often be studied by sprinkling (1) dry, fine powdered soil, or (2) flour, or (3) unscented talcum around the food. Point out to the class that some animals may actually eat the flour or talcum. Still others may be repelled from the food by these two substances.

Another way of recording the tracks of visitors involves the use of smoked paper. This is the most effective of the four methods but also the most difficult one to use. To prepare the smoked paper, hold shelf paper over a burning candle. The paper will collect carbon from the smoke, and this carbon, or soot, will record anything that touches its surface. Smoked paper is sometimes too effective, however, for it records averything from insect tracks to seeds and materials blowing in the wind.

Have the students check the bait as early as possible the next day. Which food was eaten? Were footprints recorded? Try the same setup two or three times for conclusive results.

FIELD MICE:

Field mice may be living in the vacant lot you are studying. A field mouse population is almost certain if the lot is low and moist with dense vegetation.

Have each team look carefully for runways which honeycomb the ground surface just below the matted vegetation. They should notice entrances which look like round holes or separations in the vegetation. They can follow the the runways by carefully parting the vegetation. Droppings, nests, and entrances to underground tunnels will be found along the runway.

It is sometimes easier to locate runways if there is snow on the ground. The best snow conditions for exploring runways occur during early spring when the snow has melted down to about two inches from the ground, with a crust on top. The raised outline of runways can often be seen on the surface of the snow, and the entrances will appear as round holes or cracks in the snow. After a fresh snowfall you might even see mouse tracks across the surface of the snow.

Have the students use a small garden trowel to remove the snowy roofs from the runways. For recording, they can use clipboards or paper tacked to a board. Have them place the droppings and nests found along the runways in plastic bags and include in the bags a description of where they were found.

Field mouse runways can be mapped easily by students using a grid system - or graph paper. See the back of the book for mapping suggestions.

BUGS:

Select one or more of the following means of trapping insects and other things that crawl, creep or fly through the lot.

1. Water and Detergent Trap:

You will need soup or juice cans which are three-quarters filled with water. A drop of liquid detergent will reduce surface tension so that insects sink when they land on the water surface. Some of these cans should be buried level with the ground surface to catch walking insects. Others should be placed at random around the plot.

2. Sticky Traps:

Fly paper cut into squares makes a good trap to fasten to leaves, tree trunks, and other places which would be too difficult to reach with other traps.

3. Plaque Traps:

Have each team set tiles or flat boards at random around the lot and check under them after a week or so. Surface bugs, such as sowbugs, millipedes, and slugs may have taken up residence. Rocks and other materials which are already in the lot may yield these bugs also.

4. Careful Observation:

Have the students look on the ground and under things, on trees and leaves and any other place which might harbor an insect.

5. Insect Nets:

The students should swing an insect net so that it brushes the surface of plants in each plot. They will be surprised at the insects they didn't know were there. Practice will make them even more successful.

Source: Vacant Lot Studies

3.0 THE COMPONENTS OF AN URBAN ECOSYSTEM, MAN'S EFFECT ON THESE COMPONENTS, AND THE NEED FOR IMMEDIATE AND LONG RANGE PLANNING TO INSURE QUALITY OF LIFE

THE CITY IS. . . .

Part I 3.1 Resources in an urban ecosystem

3.1.1 The ways land is used in the city

3.1.1.1 The types of housing in the city

3.1.1.2 The types of industries in Jacksonville

3.1.1.3 The types of commerce in Jacksonville

3.1.1.4 The types of transportation serving Jacksonville

3.1.1.5 The uses by government of land in Jacksonville

3.1.2 How man affects urban air

3.1.2.1 The kinds and sources of urban air pollutants

3.1.2.2 How cities make their own weather

3.1.3 The importance of ground and surface water to the City of Jacksonville

3.1.3.1 The supply, distribution, and use in the city of ground water

3.1.3.2 Characteristics and function of surface water in the city

3.1.3.2.1 The characteristics of the St. Johns River

3.1.3.2.2 The functions of surface water in the city of Jacksonville

3.1.4 To recognize urban plants and animals, their habitats, food and adaptations

3.1.4.1 To recognize urban plants, their habitats, and adaptations

3.1.4.1.1 Some of the urban plants are cultivated by man

3.1.4.1.2 Some urban plants are volunteers

3.1.4.2 Urban animals, their habitats, food, and adaptations

3.1.5 The sources and kinds of energy used in Jacksonville

3.1.5 IPO Criterion Test:

For intermediate grade students of environmental studies to develop an awareness of the sources and kinds of energy used in Jacksonville so that 75% of the students answer correctly 8 of 10 questions on a multiple choice test.

Circle the letter of the correct answer to each question.

1. The source of all energy is
    a. the sun
    b. power plants
    c. dams

2. In Jacksonville the fuel used by our power plants is
    a. coal
    b. natural gas
    c. oil

3. Natural gas is used in many homes
    a. for lighting
    b. for heating and cooking
    c. for running cars

4. Fossil fuels were once
    a. dinosaurs
    b. green plants
    c. electricity

5. In Jacksonville the electricity we use in our homes and businesses comes from
    a. telephone poles
    b. pipelines
    c. power plants

6. Most of the oil used in Jacksonville comes from

   a. the United States
   b. Florida
   c. foreign countries

7. A large user of energy in the city is

   a. radios
   b. cars
   c. traffic lights

8. A kind of energy being developed by Offshore Power Systems is

   a. nuclear
   b. solar
   c. electrical

9. Once energy is used it is

   a. stored
   b. recycled
   c. lost

10. Fossil fuels are

    a. nonrenewable
    b. plentiful
    c. renewable

To the Teacher

Energy

Energy is what makes things go. It is what moves things, supplies things and amkes things grow. We need food, and food is a part of energy. Plants are made so they get energy from the sun. The sun is the source of all energy. Once this energy is used it cannot be recycled and used again. There is a flow of energy in nature. Plants, animals, and humans will interrupt this flow of energy; catching it, redirecting it and using it to change or shape the world in their own ways.

As energy from the sun reaches the earth some of it is taken into the earth of things on the earth. It heats the ground, the water, buildings and homes, farms and highways. Some of the sun's energy is captured by green plants. Green plants, through the process of photosynthesis, make food in the form of sugar. Only green plants are able to change sunlight into food. Every other living thing on earth, either directly or indirectly, uses this food produced by green plants. If these green plants are not eaten by animals or man they die and become part of the soil. After many years some of this soil is compacted and forms peat.

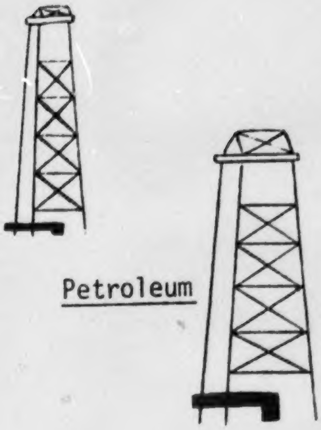
After millions of years this peat is turned into fossil fuels. We know these forms of "captured sunlight" as coal, oil and natural gas. Man takes these fossil fueld from the earth and burns them to produce energy. Man must use energy to get energy. Nature still forms fossil fuels, but at a rate one million times slower than man is using them. Because they form slowly, we consider them nonrenewable. Man uses up in one year what nature took a million years to make. If we continue to use fossil fuels at the present rate, there will come a time when there will not be enough oil, coal and natural gas to operate our factories and light our cities.

Man must use his supply of fossil fuels more wisely and develop new energy sources.

STUDENT ACTIVITY

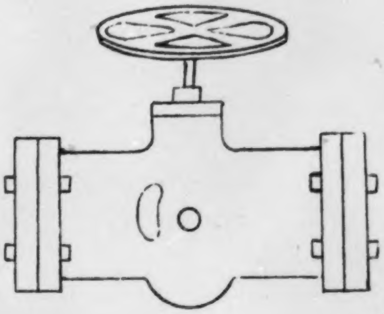
Energy Sources

PETROLEUM - is one of our most important energy sources because it can be used in many different ways. It is the fuel our power companies use to produce electricity. The plugs in the walls of our homes, schools and businesses are connected to wires which come from the power plant. Giant turbines make the electricity and send it to our homes. To make the turbines move, the electric company uses heat. This heat is produced by burning oil. Petroleum also provides the heating fuel for our homes and it is made into the gasoline that runs our cars, trucks, airplanes and industrial machinery. Petroleum is the raw material in petrochemicals which are used to make items such as phonograph records, toys, lipstick, and hair curlers.



Petroleum

NATURAL GAS - natural gas, which heats many homes, is not the same as gasoline. It is more like the gas which circus people put in balloons. When natural gas burns, it makes a blue flame. It comes from wells in the ground and travels hundreds of miles in underground pipes to your home. In Jacksonville we use natural gas to heat our homes, to cook with and heat our water.



Natural Gas

Student Activity (cont.)

3.1.5
M, LA SC

Most of what we do for work and play depends upon energy sources.

Can you name any of these sources?

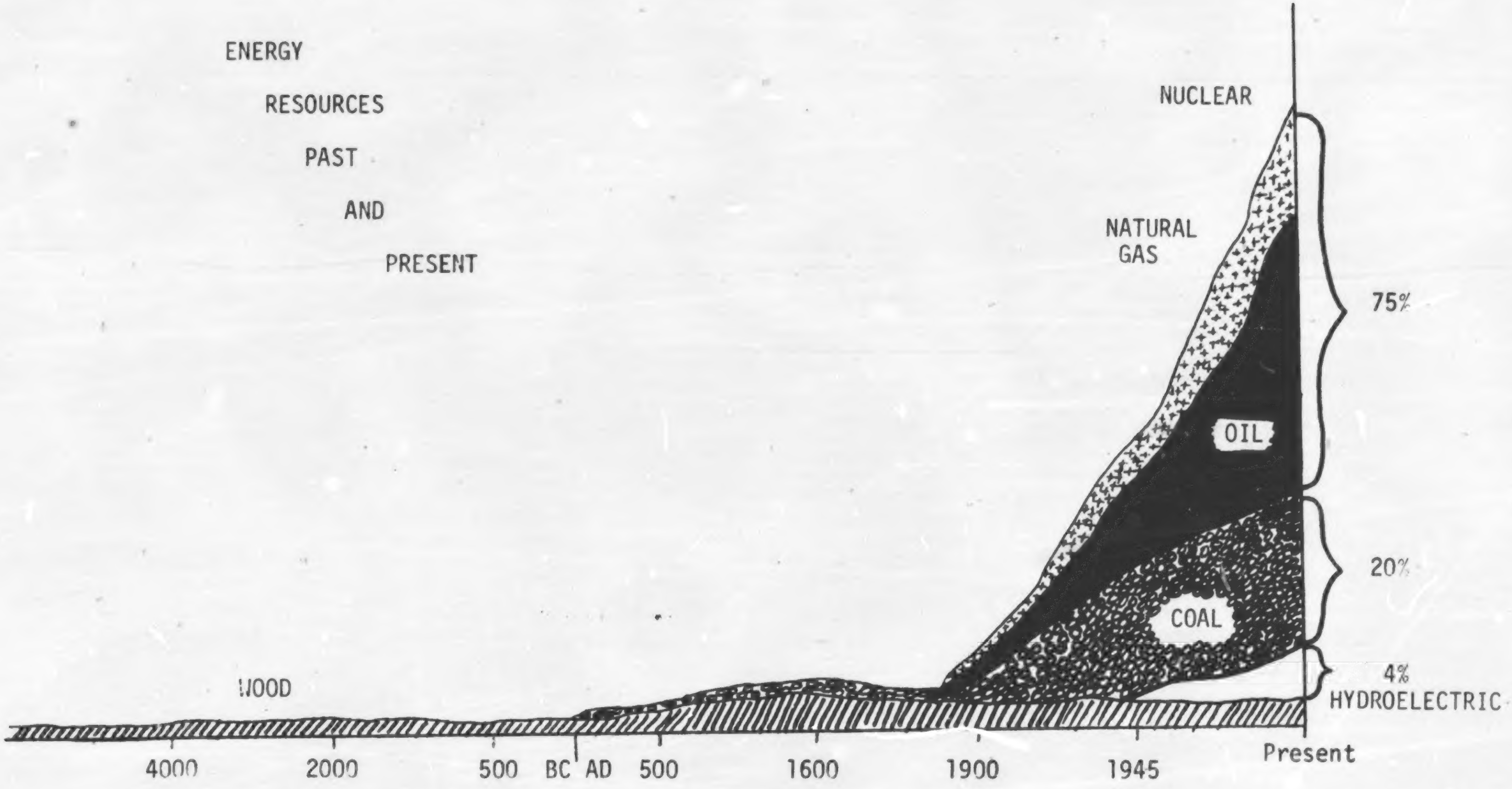
If you said coal, petroleum--maybe natural gas and nuclear power--you were right. Look at the chart on the next page. What energy sources are shown on the chart? List them below.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

Except for wood, these are the major sources of energy in the United States. Can you name one way we use each of these sources? Write your answers below and discuss them with your classmates.

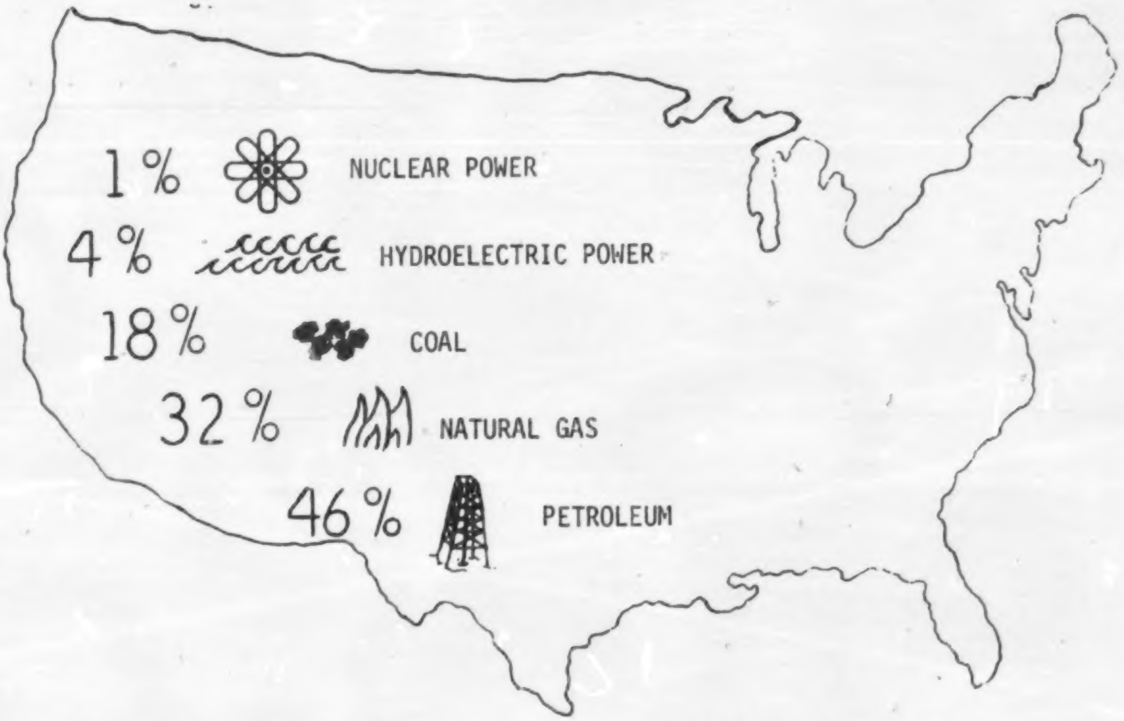
1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

ENERGY RESOURCES PAST AND PRESENT



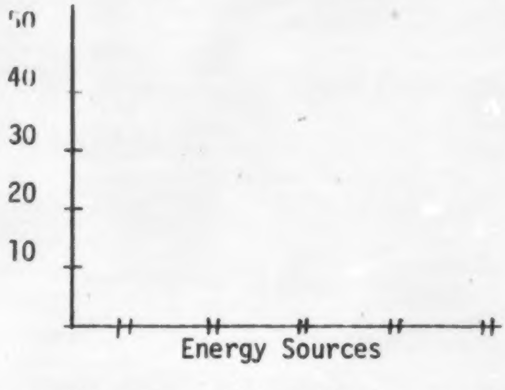
STUDENT ACTIVITY

SOURCES OF ENERGY IN THE UNITED STATES (Approximate)


1% NUCLEAR POWER
4% HYDROELECTRIC POWER
18% COAL
32% NATURAL GAS
46% PETROLEUM

Using the map and information given above, make a bar or line graph, showing the relationship among the different sources of energy.

Bar or line graph



Now that you have made your graph, answer the following questions.

1. Which source provides us with the most energy?
2. Which source provides us with the least energy?
3. Which source comes from rapidly moving water?
4. Which source must be dug from the ground?

Student Activity

In our "all electric world" we often take for granted the electricity we use for light, heat, and power. Most electrical power is generated by the combustion of stored fossil fuels, the controlled reaction of radioactive materials, and utilization of the potenial energy present in falling water. Try to find out what effects the construction of new power facilities may have on your environment.

What is your town's source of electrical energy? ______________________

How is it produced? ______________________

How do you use electrical energy in your day-to-day life? For one day, keep track of the times you use electricity. Also list the purpose for which you used this electricity.

My daily use of electricity:

use	Purpose

How many of these uses could you do without and still lead a comforable life?

There is currently a great concern in our country over power shortages. Can you think of any way to eliminate this shortage without producing more electricity and building more power dams: How?

How is your home heated?

What is the original source of this energy?

Source: The Urban Ecosystem

Consumption of Natural Resources

Have each class member list the renewable and non-renewable resources he or she has consumed in the past 24 hours and identify each as essential to survival, necessary for maintenance of life style, or luxury. List alternatives that would reduce waste of non-renewable resources.

Compile a master list of student responses and discuss interesting data that is produced.

Source: 100 Teaching Activities in Environmental Education